The Programmer

The Programmer User's Guide

KAYE

Digitized by the Internet Archive
in 2026

https://archive.org/details/manualsplus_12133

Kaye Programming Utility

User's Guide

Document No. M4198-3
First Edition, Rev. 3
May 1995
(For use with Software Level 3.00)

Kaye Instruments, Inc.
15 De Angelo Drive
Bedford, MA 01730
(617) 275-0300
FAX (617) 275-9024

This document discloses information considered proprietary to Kaye Instruments, Inc. Neither this document nor the information disclosed herein shall be reproduced or transferred to other documents, or used or disclosed to others for any purpose, except as specifically authorized in writing by Kaye Instruments, Inc. The information contained in this document is subject to change without notice and should not be construed as a commitment by Kaye Instruments, Inc. Kaye Instruments, Inc. assumes no responsibility for any errors which may be in this document.

Copyright © 1989 by Kaye Instruments, Inc. Printed in USA.

Digistrip is a registered trademark and Digi-Link, KVIEW and Mini-KVIEW are trade names of Kaye Instruments, Inc.

IBM and Personal System/2 are registered trademarks and AT is a trademark of International Business Machines Corporation.

MS-DOS is a registered trademark of Microsoft Corporation.
EZ-Install is a trademark of The Software Factory, Inc.

Contents

1. Getting Started

Introduction 1-1
Hardware Requirements 1-2
Wiring the Communications Link 1-3
Kaye I/O Baud Rate and Unit ID 1-4
Installing the Software 1-6
Starting the Program 1-7
Passwords 1-7

2. Using The Programmer

On-line Programming 2-1
Off-line Programming 2-2
Calibration 2-2
Utilities 2-2
On-line Help 2-3
Entering a Programming Area 2-3
Selecting the Kaye I/O Address 2-7
Editing a Screen 2-8
Descriptions 2-9
Saving the Data 2-9
Viewing Real-time Data 2-10
Switching Program Areas 2-11
Programming Multiple Addresses 2-12
Using a Template 2-12
Error Messages 2-12
Exiting 2-13

3. Programming the Kaye I/O

Date and Time 3-1
Configuration 3-3
Scanner Mapping 3-4
I/O Ports 3-4
U.S./European Data Format 3-5
Master Relays 3-5
Security 3-5
Report Definition 3-6
Limit/Sequencer Messages 3-7
Accumulation Totals 3-7

3. Programming the Kaye I/O, cont.

Channels 3-8
Multi-channel Functions 3-13
Programming Multiple Channels 3-14
Using Channel Templates 3-15
Viewing Channel Output Data 3-20
System Constants 3-21
System Timers 3-22
Text Messages 3-24
Historical Buffers 3-26
Sequencer Configuration 3-27
Relay Latching 3-30
Auto-Trend 3-31

4. Calibration

Overview 4-2
Temperature measurement standards . . . 4-3
Intelligent RTD Probe 4-3
Manual Value 4-4
Digi Channel Value 4-4
Temperature reference 4-4
Setup 4-8
Connecting the Kaye I/O, PC, IRTD and temperature reference 4-8
Setup probe 4-10
Sensor Installation 4-10
How a calibration operates 4-11
Calibration documentation 4-12
Corrected Results Reports 4-13
Calibration Summary Report 4-13
Performing a Calibration 4-14
Specify the calibration parameters 4-14
The Calibration Process 4-19
Stability Evaluation 4-19
Deviation Evaluation 4-20
Corrected Results 4-22
Calibration Check after the Validation Study 4-24
Calibration Summary Reports 4-25

5. Utilities

Key Commands 5-1
Backup 5-2
Restore 5-4
Compare 5-6
Listing 5-8
Delete 5-10
Password 5-11
Initialize I/O 5-12
Copy 5-13

6. Kaye I/O Reference

System Architecture 6-1
System Inputs 6-3
Mapping Input Data to Kaye I/O Channels ... 6-5
Assigning a Function 6-7
    Input Functions 6-7
    Analysis & Reduction Functions 6-7
Function Library 6-9
Additional Parameters 6-9
Channel Parameters 6-11
Sources 6-13
Numerical Sources 6-15
    CALC Channels 6-17
    Constants 6-19
Logical Sources 6-20
    Relays 6-20
    Status Inputs 6-23
    System Timers 6-25
    Channel Addresses 6-29
Historical Buffers 6-31
Reports 6-35
Messages 6-37
Auto-Trend 6-39
System Outputs 6-51

Appendix A Key Commands A-1

Appendix B The Programmer Files B-1

Appendix C Hex - ASCII Equivalents C-1

Appendix D Editing the Operator Menu D-1

Glossary Glossary G-1

Index Index I-1

Figures

1-1. 25-pin to 25-pin connection 1-3
1-2. Kaye I/O DIP Switch S7 1-4
4-1. Complete Calibration System 4-8
4-2. Sample Corrected Results Report 4-23
4-3. Sample Calibration Summary Report ... 4-27
6-1. Kaye I/O System Architecture 6-2
6-2. Mapping Inputs to Channels 6-4
6-3. Assigning a Function 6-6
6-4. Function-specific Channel Parameters .. 6-10
6-5. Data Sources for Functions 6-12
6-6. Numerical Sources 6-14
6-7. CALC Channels 6-16
6-8. Constants 6-18
6-9. Relays 6-20
6-10. Status Inputs 6-22
6-11. Programming System Timers 6-24
6-12. System Timer as Source 6-26
6-13. Channels as Numerical/Logical Sources . 6-28
6-14. Programming Historical Buffers 6-30
6-15. Historical Buffer Function 6-32
6-16. Sample Report 6-34
6-17. Programming Text Messages 6-36
6-18. 6-Point Historical Trend 6-38
6-19. 12-Point Historical Trend 6-40
6-20. Digital Trend 6-42
6-21. System Outputs 6-50

Tables

1-1. Baud Rate Settings, DIP Switch S7 1-5
1-2. Unit Identifiers, DIP Switch S7 1-5
4-1. The Calibration Process 4-6
6-1. Kaye I/O Function Library 6-8
6-2. Chart Speeds 6-44

1. Getting Started

This guide describes The Programmer, a software utility for programming Kaye I/O hardware.

Introduction

The Programmer, which requires MS-DOS Rev. 3.1 or higher, includes help with Kaye I/O operation, descriptions of all functions, and context-specific help with programming.

You can program on-line or off-line. Working on-line, you program a single Kaye I/O unit at a time. Errors are flagged by the Kaye I/O hardware immediately, and you can debug as you program.

Working off-line, you can develop an entire program without being connected to a Kaye I/O unit. Error checking is done by The Programmer. Use the Restore utility to load the program to the Kaye I/O.

The guide tells you how to:

- connect your computer to a Kaye I/O unit
- program the Kaye I/O
- copy data from one address to another
- view real-time data
- calibrate thermocouples and RTD's automatically
- back up, restore or copy a program
- restore a program or portions of it
- compare a current Kaye I/O database with a back-up file
- print a program listing
- password protect The Programmer

The last section of the guide, which is intended for readers unfamiliar with Kaye I/O, describes the hardware operation.

The guide uses the following conventions:

Kaye I/O refers to the S, M and C models of the Digistrip 4 and Digi-Link 4, including the Plus series.

SMALL CAPS indicate a key. For example, F1 displays screen help or the action key menu.

SMALL CAPS WITH HYPHEN indicates keys used together. Hold down the first key; then press the second. For example, ALT-K displays Kaye I/O help.

↑, ↓, →, ←, TAB → and TAB ← control the cursor.

Select means move the cursor or highlight to an item and press ENTER.

Enter means key in the data and press ENTER.

Hardware Requirements

Digi 4 models (S, M and C) with software 2.10 and greater. Digi 4 Plus models (S, M and C).
The Programmer runs on the IBM PC, PC/XT, PC/AT and compatibles, and PS/2. It also runs on the IBM 7561/62, 7552 and 7531/32 Industrial Computers, and on lap-tops that meet the minimum hardware requirements:

- 10 MB hard disk drive
- One 1.44M, 3½" floppy disk drive
- 640 KB RAM
- EGA or VGA graphics with appropriate color monitor
- One serial and one parallel I/O communications port:
  COM1 to connect the Digi, Kaye IRTD probes and Kaye temperature reference (for use during sensor calibration)
  LPT1 port to print program listings, calibration summary reports or Collect reports to parallel printer

Hardware options include:

- Parallel printer to print calibration summary reports and program listings from PC.

Wiring the Communications Link

RS-232 Direct Connection

If COM1 on your computer is a 9-pin port, use the 9-25 pin cable supplied with The Programmer. Plug the 25-pin end of the cable into the RS-232 port on the Kaye I/O.

If COM1 is a 25-pin port, install a 25 to 25-pin RS-232 cable wired *only* for pins 2, 3 and 7, with pins 2 and 3 cross-wired (2 to 3, 3 to 2 and 7 to 7), between COM1 and the RS-232 connector port on the Kaye I/O unit. At the Kaye I/O, short pins 4 and 5 together, and pins 6, 8 and 20 together.

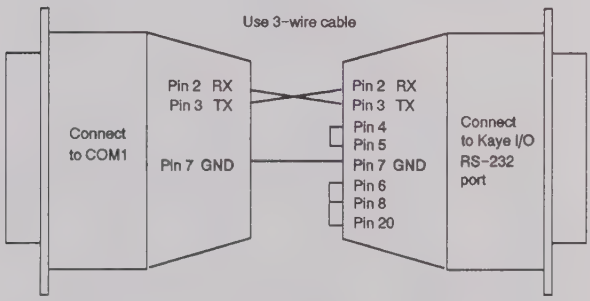


Figure 1-1. 25-25 pin connection

Extended Distances

Kaye I/O units also provide a 20 mA current loop communications interface for distances of 50-1000 feet.

Interface converters are readily available for converting your computer's RS-232 output to 20 mA current loop. Contact Kaye's Applications Engineering department for sources and pricing.

Kaye I/O Baud Rate and Unit ID

Set the Kaye I/O communications baud rate and unit ID with DIP Switch S7 on the Interface I/O panel (Figure 1-2). The Interface I/O panel on the Digistrip 4 and 4 Plus models is at the rear.

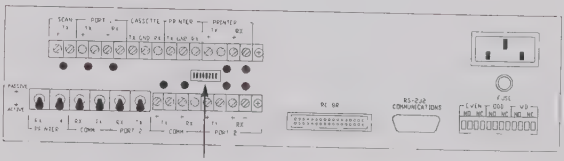


Figure 1-2. DIP Switch S7 on the Kaye I/O Interface Panel

Slides 1-3 on Dip Switch 7 determine the baud rate. Settings are shown in Table 1-1.

Slides 4-8 determine the Kaye I/O unit ID. Table 1-2 shows you how to specify a unique ID for each hardware unit in your plant. When you start The Programmer, it automatically determines the baud rate and ID of the Kaye I/O unit.

Table 1-1. Communications Port Baud Rate DIP Switch S7

Baud Rate	*Slide Number*		
	1	2	3
110	OFF	OFF	OFF
300	OFF	OFF	ON
600	OFF	ON	OFF
1200	OFF	ON	ON
2400	ON	OFF	OFF
4800	ON	OFF	ON
9600	ON	ON	OFF

Table 1-2. Unit Identifiers, DIP Switch S7

ID#	*Slide Number*				
	4	5	6	7	8
01	OFF	OFF	OFF	OFF	ON
02	OFF	OFF	OFF	ON	OFF
03	OFF	OFF	OFF	ON	ON
04	OFF	OFF	ON	OFF	OFF
05	OFF	OFF	ON	OFF	ON
06	OFF	OFF	ON	ON	OFF
07	OFF	OFF	ON	ON	ON
08	OFF	ON	OFF	OFF	OFF
09	OFF	ON	OFF	OFF	ON
10	OFF	ON	OFF	ON	OFF
11	OFF	ON	OFF	ON	ON
12	OFF	ON	ON	OFF	OFF
13	OFF	ON	ON	OFF	ON
14	OFF	ON	ON	ON	OFF
15	OFF	ON	ON	ON	ON
16	ON	OFF	OFF	OFF	OFF

If you are using KVIEW or Mini-KVIEW, follow the wiring instructions in the Kaye I/O Supplement section of the *KVIEW* or *Mini-KVIEW User's Guide*.

Installing the Software

Insert the original program diskette with write protect disabled in Drive A and enter:

A:INSTALL

Notes:
You need 1.5 MB of free hard disk space in order to install the Programmer.

The installation procedure was developed using The Software Factory, Inc., EZ-INSTALL Installation Aid, version 4.00.

The Programmer is licensed for use on a single computer. You are, however, encouraged to make a backup copy for your own use after installing The Programmer on your hard disk.

At the prompt, enter your name and company and then press ESC.

By default, The Programmer files are installed on drive C in the \KPROG subdirectory. When prompted, enter D, E or F if you want to install the Programmer on a different drive. Files contained in The Programmer are listed in Appendix B.

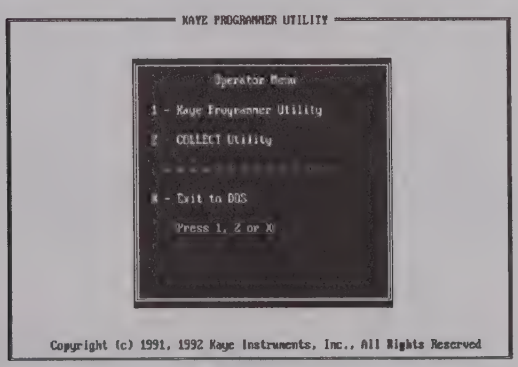
The files you create (*.BKP) and the calibration summary report files (*.RPT) are stored in the \KPROG subdirectory. When prompted, you can change the Path (the drive and directory) of these files. The Path you specify is entered in a file called K_PATH. If you want to change the path after the installation is complete, edit the K_PATH file.

When prompted for the monitor type, enter C for color or M for monochrome. After installation, you can change the monitor type by entering MAKECOL or MAKEMON in the \KPROG subdirectory.

Finally you will be prompted to install the alarm. This alarm sounds when the program has finished carrying out the sensor calibration procedure. Enter Y to install.

Starting the Program

To start up the program, enter KPGM at the system prompt. If the Collect program is installed, an operator menu is displayed. You can change the text on the Operator Menu (for example, translate it to another language), by simply editing the batch file. *See Appendix D.*


KAYE PROGRAMMER UTILITY
Operator Menu
1 - Kaye Programmer Utility
2 - COLLECT Utility
X - Exit to DOS
Press 1, 2 or X
Copyright (c) 1991, 1992 Kaye Instruments, Inc., All Rights Reserved

Press 1 to go to the Programmer Main Menu.

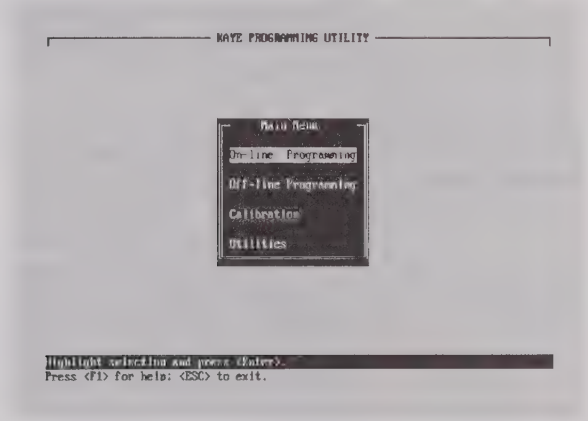
If the Collect program is *not* installed, the Programmer Main Menu appears automatically.

Passwords

There are two levels of password protection: Operator and Supervisor. The Operator password restricts access to restore, compare and listing in the Utilities Menu and to the Calibraiton selection on the Main Menu. The Supervisor password restricts access to On-line and Off-line Programming, and the Backup, Delete, Password, Initialize and Copy utilities. If a Supervisor password is defined, you can use it in place of the Operator password. *Section 5, Utilities, explains how to enter passwords.*

2. Using the Programmer

The Programmer Main Menu has four selections: On-line Programming, Off-line Programming, Calibration and Utilities.



On-line Programming

If a Supervisor password is defined, you are prompted to enter it in order to access On-line Programming. Alternatively, you can press ENTER to access only the Date and Time and System Timer areas.

You automatically build a disk file as you program (unless you are reprogramming just the Kaye I/O Date and Time or System Timers without a password). When you enter or select a file name, The Programmer checks to make sure the functions in the file match those at the Kaye I/O. If so, you can proceed. If not, you are prompted to select another file or go to the Utilities to bring the files into agreement.

Before you modify the file or the Kaye I/O, you may want to do a Compare to see where the file and the hardware program differ. Then you can choose to back up the current program into a file, restore the file to the Kaye I/O, or initialize the Kaye I/O.

When you create or modify a program on-line, the Kaye I/O hardware checks all errors immediately. You can press a key and view real-time process data to verify that your program is producing the desired results.

Off-line Programming

If a Supervisor password is defined, it is required to enter Off-line Programming.

You program off-line the same way as on-line, except that the program is not sent to the Kaye I/O. Error-checking is done by The Programmer instead of the Kaye I/O. You cannot enter Date/Time parameters or view real-time data. Be sure to restore a file created off-line to the Kaye I/O before you attempt to go on-line with that file.

Off-line Programming mode is useful when the Kaye I/O is in a remote or inconvenient location, or if you want to develop a program in advance of installation.

Calibration

The Programmer determines the stability and deviation of the sensors and temperature standard and then downloads the calibration values for each sensor to the Kaye I/O hardware. You can perform a one-, two-, or three-point calibration depending on your application. When a Kaye HTR/LTR temperature reference and Intelligent RTD probe are part of your hardware configuration, the pre-test calibration offers an automatic three-point calibration process. Use the Setup Probe screen to assign addresses to the Intelligent RTD Probes.

Utilities

The Utilities selection lets you back up a program from a Kaye I/O unit to a disk file, restore a program to a Kaye I/O unit, compare or list a program, delete a backup file, and initialize a Kaye I/O unit.

Utilities also lets you define Operator and Supervisor passwords to protect access to The Programmer.

On-line Help

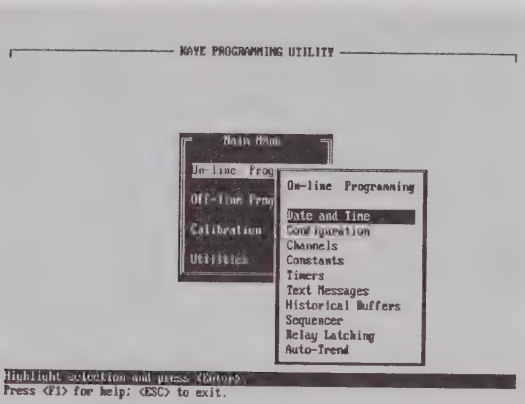
Use the following keys for on-line help:

F1	Full screen help at all menus; *and* Action key menu, at programming mode data entry screens
ALT-F1	Item help
ALT-S	Full screen help, at programming mode data entry screens
ALT-K	Kaye I/O Reference menu, at programming mode data entry screens (for Configuration, at the submenu only)

Entering a Programming Area

In On-line mode, The Programmer modifies the Kaye I/O program as you work. If you are making substantial changes, you may want to make a backup of your current Kaye I/O program before you enter On-Line Programming mode, in case you want to restore the original program. See Backup in the Utilities section of this guide.

When you select a programming mode, you automatically open a programming menu window.



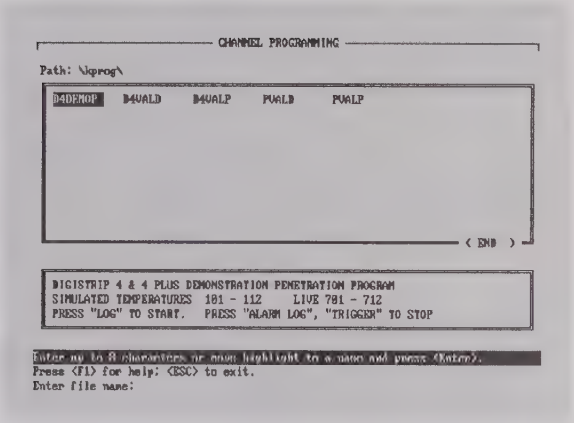
Select a programming area.

On-Line Programming, Direct Connection

You are prompted to wait while The Programmer establishes communications with the Kaye I/O and places it in Program mode.

The Programmer automatically determines the baud rate and unit ID. If there is a Program mode password defined at the Kaye I/O, you are requested to enter the password.

Once communications are established, a list of existing Kaye I/O program files appears and you are prompted for a file name. You can select one from the list or enter a name of up to eight characters, A-Z and 0-9. When you place the cursor on a file name, the file descriptor is displayed.

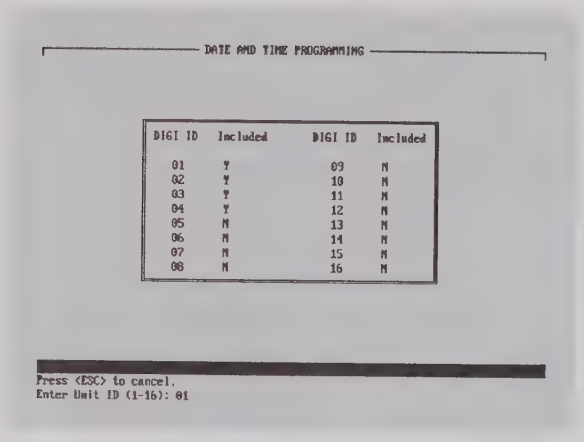

CHANNEL PROGRAMMING
Path: \kprog\
D4DEMOP
D4VALD
D4VALP
FVALD
FVALP
(END)
DIGISTRIP 4 & 4 PLUS DEMONSTRATION PENETRATION PROGRAM
SIMULATED TEMPERATURES 101 - 112 LIVE 701 - 712
PRESS "LOG" TO START. PRESS "ALARM LOG", "TRIGGER" TO STOP
Enter up to 8 characters or move highlight to a name and press <Enter>.
Press <F1> for help; <ESC> to exit.
Enter file name:

When you enter a new file name, the Programmer creates a new file initialized to the Kaye I/O defaults. Then it compares the functions in the file to those at the Kaye I/O. If the hardware has just been initialized, the functions match and you can proceed.

However, if there is a mismatch, you are prompted to select another file or go to Utilities to make the file and the hardware agree.

On-line Programming with KVIEW

When you select a programming area, a list appears, indicating the units included in the Kaye network (as specified with the KVIEW configurator).


DATE AND TIME PROGRAMMING
DIGI ID Included DIGI ID Included
01 Y 09 N
02 Y 10 N
03 Y 11 N
04 Y 12 N
05 N 13 N
06 N 14 N
07 N 15 N
08 N 16 N
Press <ESC> to cancel.
Enter Unit ID (1-16): 01

At the prompt, enter the two-digit identification number of the Kaye I/O unit you want to program. (Be sure the unit is not in program mode from the operator panel. If it is, you cannot access it with The Programmer.)

The Programmer verifies that the Kaye I/O is included in the network and that it is ready for programming. The Programmer also determines the unit type (Digi 4 or Digi 4 Plus).

Then a list of existing Kaye I/O program files appears and you proceed as above.

Off-line Programming

At the pop-up menu of Kaye I/O hardware models, select the one matching the unit you are programming.

At the next prompt, select a file name from the list or enter a new name.

You can select a file that was created for a different hardware type. However, when you restore the file to the Kaye I/O unit, unsupported functions will be rejected, and the program may contain invalid references.

Check the rejected functions and delete any references to them. Then use Backup to create a file appropriate to your unit. See Channels in the Programming section for further information.

Selecting the Kaye I/O Address

Select Channels, and the Channel Map appears. The Channel Map is a tabular representation of the functions programmed into Kaye I/O channel and CALC channel addresses (see Channels in the Programming section for more information). Highlight a channel and press ENTER, or key in a label or an address.

When you select Constants, Text Messages, Sequencer Configuration, or Relay Latching Configuration, The Programmer brings up either the first address in the sequence or, if you are returning to a programming area, the last address programmed.

At the prompt, press ENTER to select the current address, or PGDN/PGUP to scroll the addresses. You can also key in an address.

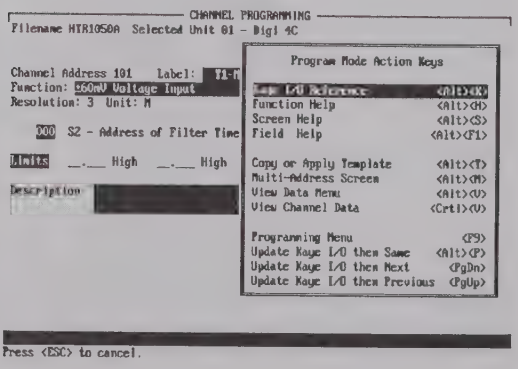
Editing a Screen

Accessible data fields appear in cyan. When you highlight a field, it becomes red or black. If the field is red, press ENTER to select an entry. If the field is black, key in an entry. You can overwrite existing characters.

Use these keys for editing:

TAB →	-	Next field
TAB ←	-	Previous field
BACKSPACE	-	Delete character to left of cursor
ALT-C	-	Clear field from cursor to end
INS	-	Insert character at cursor position
DEL	-	Delete character at cursor position
→	-	Right 1 space within field
←	-	Left 1 space within field

Press F1 for a menu of key commands (Program Mode Action Keys). Valid keys are shown in white. You can select a command or enter the desired key or key combination.



The following commands are valid at all programming screens:

F1	- Action Key menu
ALT-S	- Screen help
ALT-F1	- Field help
ALT-K	- Kaye I/O reference (in Configuration, valid at submenu only)
ALT-V	- View Data menu
F9	- Programming menu

After editing a field, press ENTER. If The Programmer detects invalid syntax, you get a message and the cursor remains at that field. If your entry is accepted, the edited field becomes yellow and remains yellow until you save the data.

Descriptions

You can enter a description for each Kaye I/O address, incorporating permanent documentation into program storage. The descriptions, unlike other fields, are not overwritten during a backup. However, you can edit the descriptions.

Saving the Data

There are four commands for saving the data to the programming file and, if you are on-line, to the Kaye I/O unit.

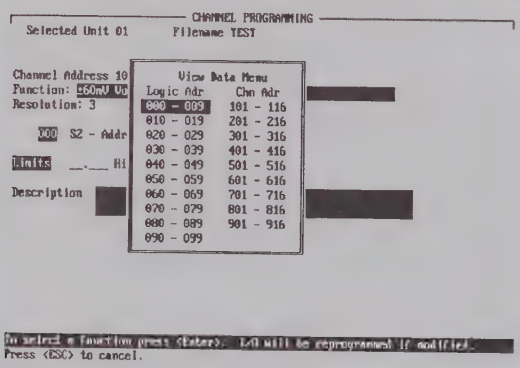
ALT-P saves the data and lets you continue programming at the current address.

PGDN or PGUP saves the data and takes you to the next/previous address within the programming area. Scroll the address with PGDN or PGUP.

ESC saves the data and exits to the programming menu or, if you are programming channels, to the Channel Map.

Viewing Real-time Data with ALT-V

When you are working on-line, you can look at real-time values at the Kaye I/O. Press ALT-V for the View Data Menu.



Select a group of 10 logic addresses or 16 channels (or 9 CALC channels for the Digi 4 Plus).

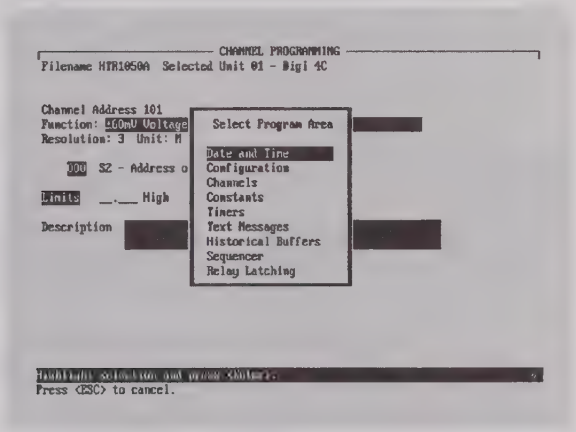
At the View Data screen for logic addresses, you see the On/Off state of the logic bits. At the View Data screen for channels, you see the label, output value, engineering units, alarm state, and logic bit state for each channel. Alarms are indicated with a red "A". The View Data screen for CALC channels displays the label, output value and engineering units.

The View Data screens update continually with new values from the process. The screens are for monitoring and debugging only. You cannot enter data.

At the Channel and System Timer screens, you can press CTRL-V to see the real-time channel output value or reset times. See Channels and System Timers in the Programming section for more information.

Switching Program Areas with F9

To switch temporarily from one programming area to another, press F9 for the Programming Menu.



Select a new area. The Programmer reminds you that you are working from the F9 menu with the prompt, "Press ESC to return to [previous area]."

Edit and save as many screens as you wish in the new area, using PGDN or PGUP.

You can make only one switch at a time from any programming area. You need to return to your previous area in order to use F9 again. When you press ESC, you return to the same address and mode (single or multiple address) in the previous area.

Programming Multiple Addresses

In two areas, Channels and Sequencer Configuration, ALT-M calls up a multi-address programming screen. This lets you program four consecutive channels or five consecutive sequencer addresses on one screen, saving time and reducing the potential for error, especially when you are programming multi-channel functions.

To save all the data and go to the next/previous group of addresses, press PG DN or PG UP. To save and return to the single address screen, press ALT-M again.

Using a Template

For Channels, Messages, Sequencers and Trends, you can call up a template with ALT-T. Templates let you copy a set of parameters from one address to other addresses. The Channel template also lets you copy multiple addresses and store them in a disk file.

See the individual programming areas for more information on using templates.

Error Messages

If you get a message saying "Invalid address," "Invalid format for value," or "Data not accepted at Kaye I/O", press ALT-C to clear the field and re-enter the data. Check the prompt line for a help message, or press the field-specific help key.

Exiting

Press ESC to exit the programming menu.

If you are *off line*, you are prompted,

"Select: (Q=Quit, S=Save) S."

Quit

Enter Q to exit without saving a file. At the prompt,

"Confirm quit. All edits will be lost. (Y/N) N"

enter Y to exit or N to clear the command line and continue.

Save

Accept the default S to save. At the prompt,

"Save (file name)"

press ENTER to save the edits under the current file name, or enter a new name. If the file name exists, you are prompted,

"File already exists. Replace? (Y/N) N"

Enter Y to replace or N to clear the command line and continue. If you save a file under a new name, your original file is preserved.

When you are programming *on line*, ESC takes you directly to the "Save (file name)" prompt.

To exit The Programmer, press ESC until you see the DOS prompt.

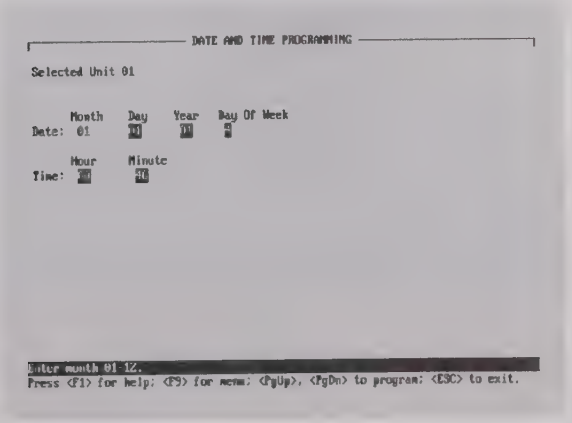
3. Programming the Kaye I/O

Date and Time

The system clock in Kaye I/O units keeps track of the current year, month, day, hour, minute and second. The clock has a battery backup, and continues to run if the power goes off. It controls all timed operations in the unit.

When you initialize your Kaye I/O unit, the system clock is reset to January 01. After initialization and at certain other times, such as the switch to Daylight Saving Time, you must set the clock to reflect current date and time. Each unit must be set separately. (When you reset the clock on a standard Digi 4, check the system timer reset times to make sure they are still valid. When you reset the clock on a Digi 4 Plus, system timers are updated. See page 3-23.)

Select Date and Time at the programming menu window. (This area is accessible only in On-line Programming mode.)



Enter the date and time parameters.

Month
When you enter 01 to 12, The Programmer automatically limits the number it will accept for **Day**. For example, if the Month is 02, valid entries for Day are 01-28. (In a Leap Year, however, 29 is a valid entry.)

Day of the Week
You can choose which day (typically Sunday or Monday) is day 1, and then enter the number (1-7) for the day you are actually programming. For example, if you select Sunday as day 1 and today is Wednesday, enter a 4 for Day of the Week.

Synchronizing Digi 4 Plus Times with KVIEW

KVIEW and Mini-KVIEW give you the option of synchronizing the clocks in the network by broadcasting the computer's date and time at 10-minute intervals to all configured Digi 4 Plus units. (The systems must all be at software level 2.10 or above, or the broadcast is disabled.)

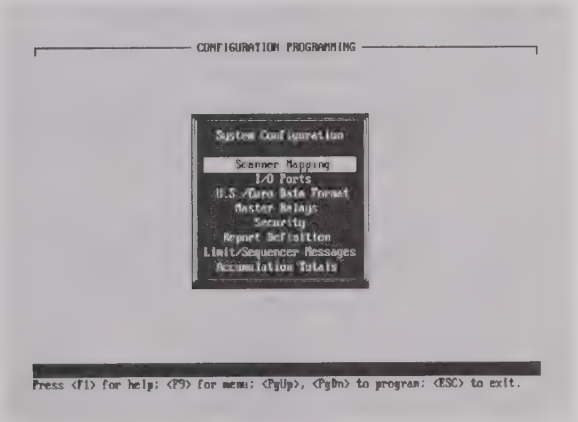
Configuration

This area includes a range of tasks. One of them, the assignment of input scanner banks to Kaye I/O channel addresses, is required for all users, and is likely to be the first parameter you program.

Other configuration parameters may be optional, depending on your application. For example, you may use the KVIEW Report Generator to set up reports, so you will not need the Kaye I/O report formatting parameters.

You may want to exit Configuration after you assign input scanners and return later to program other parameters.

At the submenu, press F1 for Action Keys, ALT-S for screen help, ALT-K for help with Kaye I/O operation, and ALT-F1 for item help.



Scanner Mapping

Data from Analog and RTD input scanners is assigned to specific rows (1-8) in the Kaye I/O channel matrix. Scanner 1 *must* be assigned to a row of channels.

At the scanner mapping screen, enter a channel row number 1-8 for each scanner installed on the Kaye I/O unit, and select Continuous or 10-second Synchronized scanning mode.

Each scanner, except the Analog Plus/Status Input scanner, has a jumper switch that defines its bank number. The Analog Plus/Status Input scanner is fixed as Bank #1. When you buy a Kaye system with several scanners, the jumpers are factory set and each scanner is labelled with a different bank number. If you add scanners, set the jumper on each one for a unique bank number.

I/O Ports

Select this option to:

- output analog signals to the process or another Kaye I/O unit
- define printer parameters
- format program listings
- enable switched network support

Peripheral Ports

Configure Port 1 on the Kaye I/O to transmit a single row of channel data to a Kaye Analog Output module.

Printer Port

Set the printer port baud rate, lines per page and page width of the program listing.

Communications Port

Configure the page format and program listing of data sent to a computer or terminal, and enable switched network support.

U.S./European Date and Number Format

Select this option to change the date and numerical values in reports and messages from U.S. to European format.

Master Relays

Kaye I/O units have two Master Relays, ODD and EVEN, that can activate a system annunciator or switch. You can configure either Master Relay to trip when any of the unit's 48 relay logic bits trips, the ODD Master Relay to trip when any odd relay logic bit trips, or the EVEN Master Relay to trip when any even relay logic bit trips.

Set the Master Relays normally energized or normally de-energized, activate them by limit trips or returns to normal, and configure them for static operation or momentary pulse.

Security

Select this option to control access to Kaye I/O units that have an operator panel.

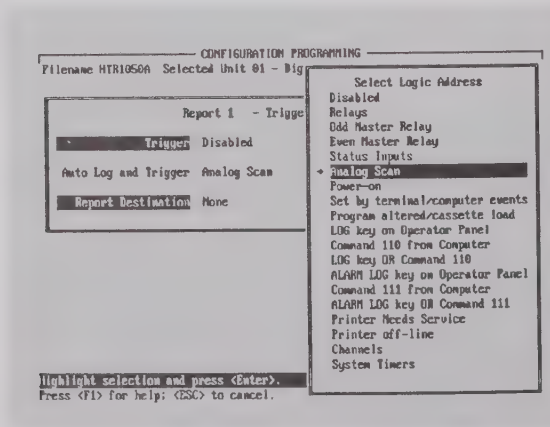
You can specify a password for entering Program mode, enable or disable the password, and specify which programming parameters are password protected.

Report Definition

Select this option to configure the data reports and the alarm status report. *(NOTE: If you are using KVIEW, Data Reports 1 and 2 are reserved for KVIEW use and are automatically configured by the workstation software.)*

A series of menus lets you select:

- two triggers for each report
- output destination of the report (printer, communications port or both)
- contents of report (channel rows, relays/status inputs, historical buffers)
- format (type and location of headers, number of lines, number of channels per line, location of channel labels, address of Date/Time, STX and ETX messages)
- buffer storage options
- triggers to release report to printer or communications port
- address of phone number for automatic transmission of report



Limit/Sequencer Messages

Select this option to specify:

- output destination of limit and sequencer messages (printer, communications port or both)
- number of messages to be stored in the text output buffer
- triggers to release messages
- address of phone number for automatic transmission of limit and sequencer messages
- address of STX and ETX messages

Accumulation Totals

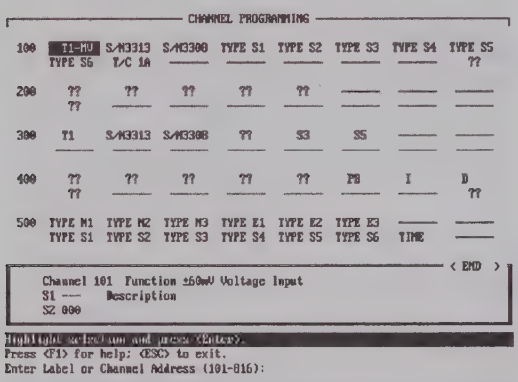
Select this option to specify:

- number of totals to be stored in text output buffer
- triggers to release totals
- address of phone number for automatic transmission of totals
- address of STX and ETX messages

Channels

To program channel and CALC channel addresses, select Channels from the Main Menu.

A Channel Map appears, showing the label programmed at each channel. Channels without a label are shown with question marks (??). Unprogrammed channels are indicated with a dash (———).


CHANNEL PROGRAMMING
100 T1-MV S/M3313 S/M3300 TYPE S1 TYPE S2 TYPE S3 TYPE S4 TYPE S5
TYPE S6 I/C 1A ?? ??
200 ?? ?? ?? ?? ?? ——— ——— ———
?? ——— ——— ——— ——— ——— ——— ———
300 T1 S/M3313 S/M3308 ?? S3 S5 ——— ———
——— ——— ——— ——— ——— ——— ——— ———
400 ?? ?? ?? ?? ?? PB I D
?? ——— ——— ——— ——— ——— ——— ??
500 TYPE M1 TYPE M2 TYPE M3 TYPE E1 TYPE E2 TYPE E3 ——— ———
TYPE S1 TYPE S2 TYPE S3 TYPE S4 TYPE S5 TYPE S6 TIME ———
< END >
Channel 101 Function ±50mV Voltage Input
S1 --- Description
S2 000
Highlight selection and press <Enter>.
Press <F1> for help; <ESC> to exit.
Enter Label or Channel Address (101-816):

The screen displays five rows of channel data. Use ↑ and ↓ to scroll through the channel rows. If you are programming a Process Link or Digi 4 Plus, you can press PGDN for a CALC Channel Map. The Programmer lets you program labels at CALC channels for use with this map and the View Data screen.

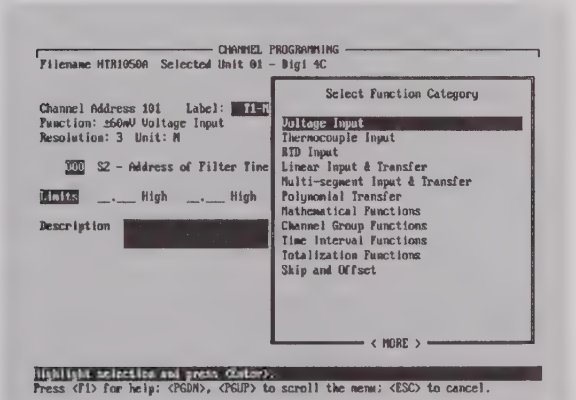
Use the cursor or tab keys to highlight a channel, or enter a channel address or label. The channel address, function, sources of channel input data, and a description, if one has been entered, are displayed at the bottom of the screen.

Press ESC to return to the Main Menu.

Press ENTER to select the channel. The channel programming screen appears and displays the details of the function programmed at that channel.

Function

The function field is highlighted, and you are prompted to press ENTER for the function menu.



Select a function category. This brings you to a submenu, where you are prompted to select a specific function.

The function determines which additional parameters appear on the channel screen. Press ALT-H for help programming parameters for the selected function.

If you are editing a file created for a Kaye I/O model with a different set of functions, you may see this message:

"Caution: Invalid function for selected I/O type."

This message will appear, for example, if you are programming a Digi 4S, using a file created for a Digi 4C which includes a PID function.

You cannot edit any parameters on the channel screen until you select a different function. If you leave the unsupported function at that channel, you will get an error message when you try to load the program to the 4S. The 4S program will be incomplete.

Label

This parameter appears on all channel and CALC channel screens. It is an important field, since it identifies the channel on the Channel Map. Labels for Channels 101-816 also appear in the program listing, accompany limit messages and can be included in reports.

Resolution

This parameter lets you define the location of the decimal point in the output data. The field is inaccessible with functions that have a fixed decimal location for the output (voltage, thermocouple and RTD).

Once you select a resolution, The Programmer automatically adjusts the resolution of current values and limits. If the limits are forced out of range, they are set to NULL.

Unit

You can enter one alphabetical character to describe engineering units for the output data. For example, enter P for pressure. The Programmer automatically specifies engineering units for voltage, thermocouple and RTD inputs.

Output

Display-only field for multi-channel functions. Indicates the data output at each channel.

S1 (Source 1) and S2 (Source 2)

These parameters hold a 3-digit address to specify the location of data required by the function. The screen displays function-specific descriptions of Sources 1 and 2.

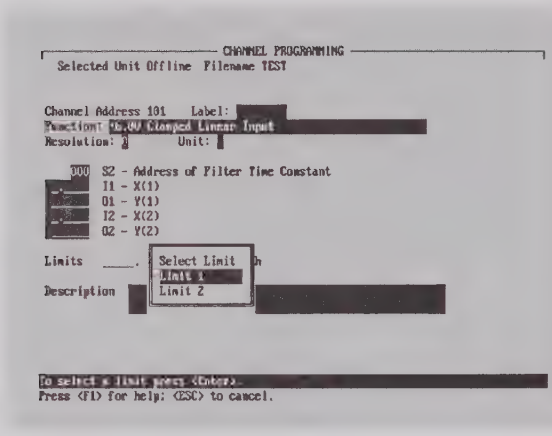
I1 (Input 1), O1 (Output 1), I2 (Input 2) and O2 (Output 2)

These parameters appear only if they are used by the function. The screen displays brief descriptions of the parameters. For many functions, if the Source 1 or Source 2 address is 000, you can enter a constant at Input 1 or Input 2 to supply the data required by the function. If you enter NULL, this command clears the field. Depending on the function, a null entry can either disable an operation, such as calibration, or reset the function defaults.

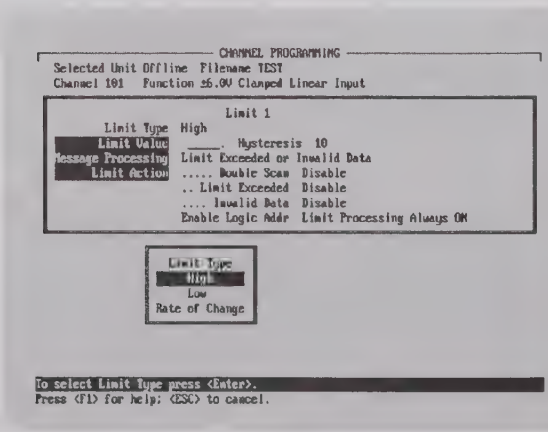
Limits

You can enter two independent limits at each channel: Limit 1 and Limit 2. Limit 1 can be high, low or rate-of-change; Limit 2 can be high or low. If you enter NULL, this command clears the field and disables limit processing at the Kaye I/O.

Follow the prompts to program limits on channel output values.



You can set a hysteresis band, assign text addresses for limit and return messages, specify the conditions for sending messages, and select the action to be taken when the channel data exceeds a limit or returns to normal.



If the channel has a logic function, you cannot enter a limit value, but you can select a limit trip on TRUE or FALSE and the action to take place when the limit is tripped.

Description

Enter a description of the channel.

This description appears on the Channel Map when you highlight the current channel, and is part of the program listing. It is stored in the file, not at the Kaye I/O.

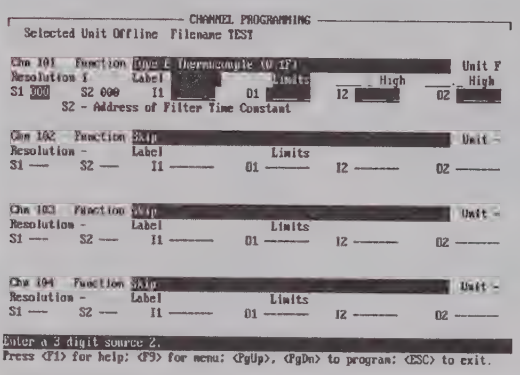
Multi-channel Functions

When you program multi-channel functions, the function field indicates the number of channels required and the relative location of the current channel. For example, the function field for the first channel in the Natural Gas Specific Volume function indicates, "Natural Gas Specific Volume - AGA 8 (1 of 11)." You access the function field at the first channel in the series.

Programming Multiple Channels on one Screen

Press ALT-M for a four-channel programming screen. The current channel address becomes the first address on the multi-channel screen.

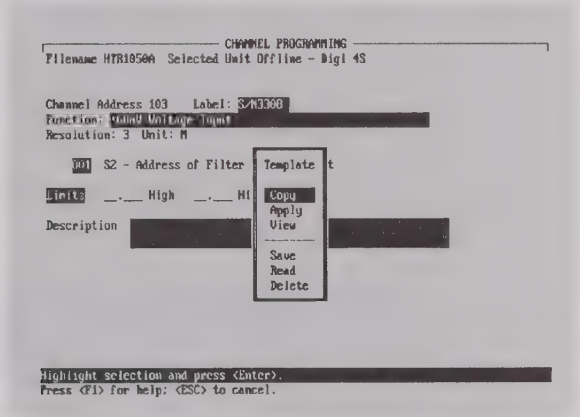
In this compressed format, the parameter descriptions are displayed as they are highlighted.



To write the data and advance or move back three channels, press PGDN or PGUP. To write the data and return to the single-channel screen, press ALT-M again.

Using Channel Templates

Press ALT-T at both single and multiple channel screens for a template menu.



At the template menu, select:

- **Copy** to create a template with parameters from up to 64 channels
- **Apply** to use the template to program the current channel or a range of channels (up to 64)
- **View** to see the template
- **Save** to create a template file
- **Read** to select a file as the active template
- **Delete** to delete a template file

Copy a single channel to a template

Access the channel you want to copy, press ALT-T, and select Copy. When prompted for the range of channels, press ENTER. If you do not specify a range, the Programmer copies only the current channel to the template.

For example, suppose you want to copy a thermocouple function programmed at Channel 101 to Channels 102 through 112. Access Channel 101, press ALT-T, select Copy and press ENTER, and then follow the Apply instructions.

Apply a single channel template

Access the first destination channel, press ALT-T and select Apply.

You are prompted, "Enter range, current channel to ____."

When you specify the end channel in the range, the Programmer applies the single channel template to every channel in the range. If you do not specify a range, the Programmer applies the template only to the current channel.

To apply the thermocouple function, access Channel 102, press ALT-T and select Apply. When prompted for the range, enter 112.

If the channel copied to the template has a non-zero source address, the sources are nulled when they are applied and you must set them appropriately via the channel programming screen. If a source is 000, it is applied as 000.

You may have to edit the label and descriptor at each channel. For example, if the label at Channel 101 is TEMP1, you need to update the labels at Channels 102 to 112 to reflect the correct temperature numbers.

Copy multiple channels to a template

You can also copy a group of channels to the template and then apply the template to a block of channels.

Access the first channel in the group, press ALT-T and select Copy. When prompted for the range of channels to be copied to the template, enter the address of the last channel in the range.

For example, suppose you want to copy the information programmed at Channels 101 to 116 to another row of channels or use it in another program. Access Channel 101, press ALT-T and select Copy. When prompted for the range of channels, enter 116 and then follow the Apply instructions. If you want to use the template with another program, save the template before you exit.

Apply a multiple channel template

Access the first destination channel, press ALT-T and select Apply. You are not prompted to enter a range. The Programmer immediately applies the template starting at the current address.

If a channel copied to the template has a source address that points to a channel within the specified range, it is updated to the new range of channels.

For example, Channels 101 to 116 were copied to the template. Channels 101 to 112 are programmed with thermocouple functions; Channel 114 is recording the maximum temperature; Channel 115 is recording the minimum temperature; Channel 116 is calculating Delta T. The sources for the Maximum and Minimum functions are Channels 101 to 112. The sources for the Delta T function are Channels 114 and 115. Since all of the sources are within the range of the template (101-116), they will be automatically updated when you apply the template.

If you apply the template to another row of channels, such as Channels 401 to 416, Channels 401 to 412 become sources for the Group Maximum and Minimum functions, and Channels 414 and 415 become the sources for the Delta T function.

If the channels copied to the template have a Source 1 or Source 2 address that points to channels outside the range of the template, the sources are nulled when they are applied. Set the sources appropriately via the channel programming screen. If the sources are 000, they are applied as 000.

NOTES

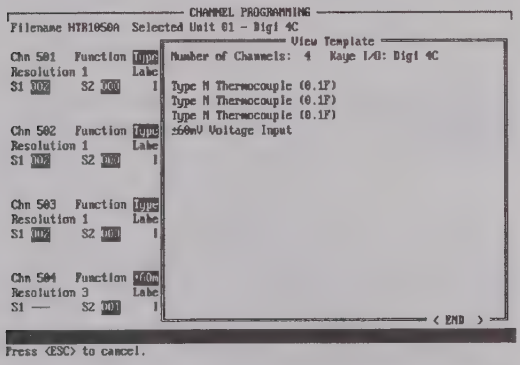
If the destination channels have been previously programmed, you are prompted for permission to overwrite the existing functions.

You cannot apply a template copied from Channels 101-816 to CALC channels.

Templates cannot wrap. For example, you get an error message if you try to apply a 20-channel template to Channel 812.

View a Template

Select View at the template menu for a window that indicates the number of channels in the template and lists them by function. If there are more than 16 channels in the template, press PGDN for additional screens.


CHANNEL PROGRAMMING
Filename HTR1050A Selected Unit 01 - Digi 4C
View Template
Chn 501 Function Type
Resolution 1 Labe
S1 J02 S2 J03 1
Chn 502 Function Type
Resolution 1 Labe
S1 J02 S2 J03 1
Chn 503 Function Type
Resolution 1 Labe
S1 J02 S2 J03 1
Chn 504 Function ±60m
Resolution 3 Labe
S1 — S2 J03 1
Number of Channels: 4 Kaye I/O: Digi 4C
Type N Thermocouple (0.1F)
Type N Thermocouple (0.1F)
Type N Thermocouple (0.1F)
±60mV Voltage Input
< END >
Press <ESC> to cancel.

Save a Template

Select Save to create a file containing the current template. A list of existing template files appears. At the prompt, select or enter a template name.

The file is stored in the C:\KPROG directory with the extension .TPL. You return to the template menu.

Read a Template

Select Read for a list of template files. At the prompt, select a file name. This file becomes the active template. You return to the template menu.

Delete a Template

Select this option for a list of template files, and follow the prompts to delete a file. You return to the template menu.

Exiting the Template

Press ESC to exit the template menu.

The channel template is cleared when you exit The Programmer.

Viewing Channel Output Data with CTRL-V

If you are programming a channel or multiple channels on-line, you can press CTRL-V to view the real-time output value at that channel or channels. The value appears in a small window on the channel screen. If real-time values for the sources are available, they are also displayed. If a source is a logical value, it appears as a series of dashes.

Press ESC to remove the window.

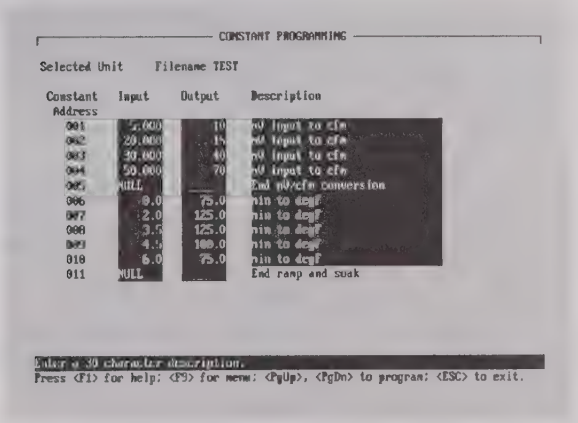
System Constants

Kaye I/O units can store a pair of constants, an Input Constant and an Output Constant, at Constant addresses 001-099. Constants are used several ways.

With the standard Digi 4, you can use an Output Constant as a source of input data to a function.

With all Kaye I/O hardware, the Input and Output Constants at consecutive Constant addresses are used with the Multi-segment Input and Transfer functions to specify segment endpoints.

Input and Output Constants are also used with the Polynomial Transfer function: Polynomial constant = (Output x 10^{Input}).

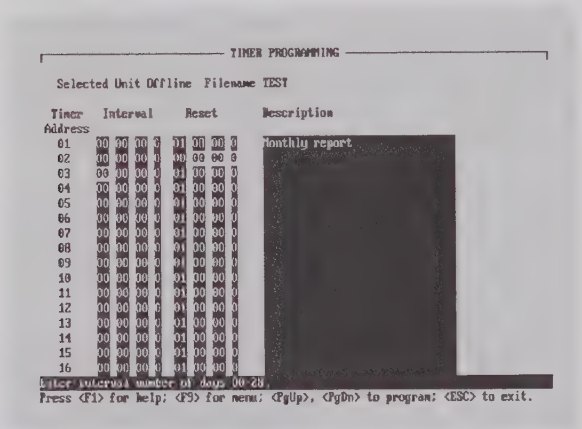


To terminate a multi-segment or polynomial function, enter the word NULL at the input constant field following the last endpoint or term.

Constants must be within the Kaye I/O's ±65535 display range.

System Timers

Kaye I/O hardware has 16 system timers, used to trigger reports, control data sampling, or reset accumulation totals. Each system timer controls a logic bit that is set momentarily true when the timer resets.



You assign two parameters to a timer: the interval and the reset time. All 16 system timers are programmed on a single data entry screen.

Interval

The Interval parameter specifies the number of days, hours, minutes and tenths of a second between resets.

Reset

The reset parameter specifies the initial start time. The Kaye I/O unit automatically updates this parameter according to the specified interval. You must make a valid entry in order for the timer to begin.

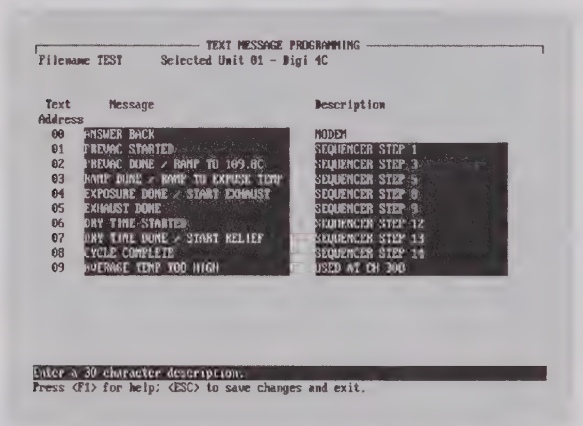
The reset time that is displayed is from the file. Press CTRL-V for a window showing the current reset times at the Kaye I/O, plus the current date and time. Press ESC to exit the window.

Note: When you restore a program to the Kaye I/O, the Programmer automatically updates the reset time to the Digi clock plus two minutes. If you update the system clock, the system timers are automatically updated.

Text Messages

Messages describe limit action or steps in the sequencer function, appear in a report header or follow the date and time to identify the company and process, specify start-of-text and end-of-text, and store autodial telephone numbers.

There are 10 screens for programming text messages, each with 10 message addresses.



Each message address accepts a string of up to 32 ASCII characters. Valid characters include the letters A-Z, numbers 0-9, and these special characters:

blank	(space)	+	(plus)
(	(left paren)	-	(minus)
)	(right paren)	,	(comma)
/	(slash)	.	(period)
*	(asterisk)		

It is a good idea to partition text addresses into meaningful groups to help prevent address conflicts. For example, you might dedicate addresses 01-40 as limit descriptors, 41-60 as sequencer descriptors, and 61-80 as report headers.

Using a template

You may want to copy a message to other addresses and then make minor edits.

To request a template, press ALT-T. A template window opens and you are prompted,

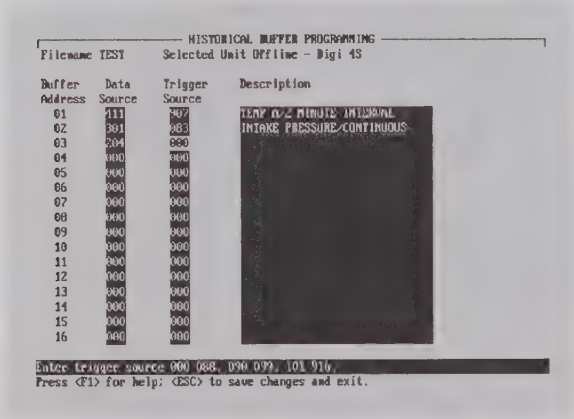
"A=Apply template to [current address] or
C=Copy [current address] to template. A."

The first time you access the template, it is empty. Enter C to copy the message at the current address to the template. The next time you access the template this message appears. Enter A to apply the template to the current address.

Historical Buffers

The 16 Kaye I/O historical buffers are first-in, first out (FIFO) buffers used for temporary storage. They store data used by historical buffer functions. Each buffer can store up to 32 data samples. You specify how many samples are to be used when you program the historical buffer function.

Each buffer has a data source and a trigger. The data source is a channel or CALC channel. The trigger is a logic bit that sends a new data sample to the historical buffer every time it makes a FALSE to TRUE transition.



Data Source

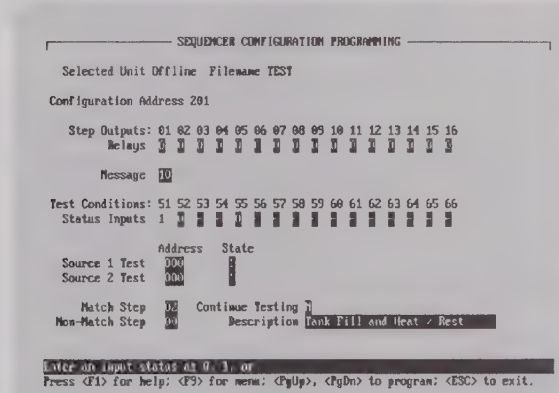
Enter a channel address 101-816 or a CALC channel address 000-099.

Trigger

Enter a logic address 001-816, 901-916. If the logic address is a system timer, you must activate it by assigning an interval and a reset time. Otherwise the timer may never turn on.

Sequencer Configuration

Sequencer configuration addresses 201-299 store data used with the sequencer function, such as test conditions, output relay specifications, and output message addresses.


SEQUENCER CONFIGURATION PROGRAMMING
Selected Unit Offline Filename TEST
Configuration Address 201
Step Outputs: 01 02 03 04 05 06 07 08 09 10 11 12 13 14 15 16
Relays
Message
Test Conditions: 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66
Status Inputs 1
Address State
Source 1 Test
Source 2 Test
Match Step
Non-Match Step
Continue Testing
Description Tank Fill and Heat / Rest
Enter an input status at 0, 1, or
Press <F1> for help; <F9> for menu; <PgUp>, <PgDn> to program; <ESC> to exit.

The core sequencer operation is one of testing status inputs and logic states against current process conditions in search of a match. Process conditions might include tank full, time elapsed, interlock complete, product at temperature, etc.

When the sequencer finds a match, it moves to the output step specified by the match address and sets the relays according to your specifications.

A non-match either terminates testing or allows additional testing at the non-match address. You can force continued testing even when a match is found by assigning a continue flag to the match address.

Sequencer inputs are:

- 16 system status inputs
- 2 system logic bits

Sequencer outputs are:

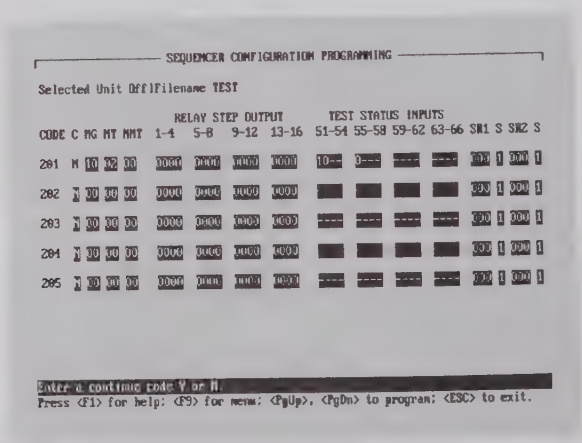
- 16 relay outputs, defined by the exit step
- an output message

Before you program the sequencer function, we suggest you make a step diagram and an I/O list. For detailed information, see the *Sequencer Function Manual* (Document M4131).

There is a data entry screen for each of the 99 sequencer configuration addresses.

Programming Multiple Addresses

To program up to five sequencer addresses on the same screen, press ALT-M.



On this compressed screen, fields are labelled as follows:

C	Continue testing after Match
MG	Message address
MT	Match Step number
NMT	Non-match Step number
SR1	Source 1 Test address
S	Source 1 Test state
SR2	Source 2 Test address
S	Source 2 Test state

Enter 1 or 0 in groups of four at the Relay state fields. Enter 1, 0 or dash in groups of four at the Test Status Input fields.

To return to the single sequencer screen, press ALT-M again.

Using a Template

To copy data from one sequencer address to another, press ALT-T for a template.

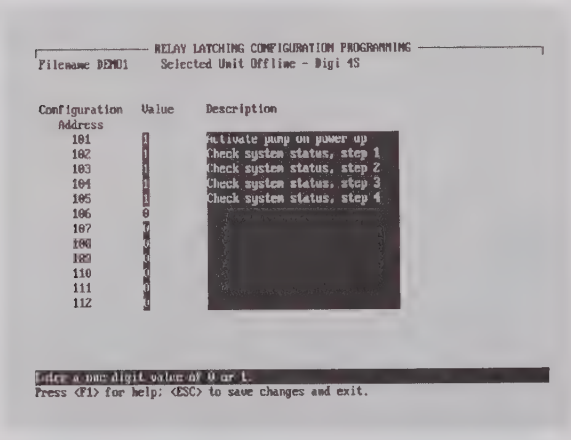
At the prompt, enter C to copy data at the current address to the template. Access the destination address and enter A to apply the template. You return to the sequencer screen.

Relay Latching

Relay Latching Configuration addresses 101-148 correspond to Kaye I/O relay addresses 01-48.

The first math scan after a power outage, a latched relay is held in the state it was in prior to the outage. A non-latched relay is always set FALSE after a power outage.

There are four relay latching configuration screens, each with 12 relays.



Value

Enter 1 or 0. 1 latches the relay, so that it is set to its state prior to the power outage. 0 unlatches the relay.

Descriptor

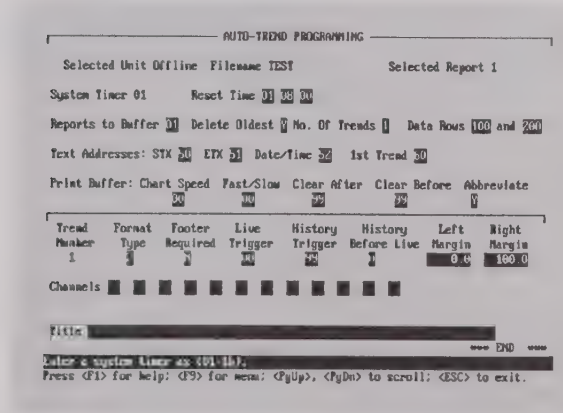
Enter a 30-character descriptor to identify the relay.

Auto-Trend

The Auto-Trend screen provides a convenient way to define a graphic report for Kaye's Digistrip 4 and 4 Plus.

The Digistrip can generate up to 9 separate trend reports from the 32 channels you select. The trend reports are printed when a trigger turns on. Because you define the format, contents and triggers of each trend, you can set up different ways of looking at the same data.

Select Auto-Trend from the Programming Menu. You are prompted to enter the number of the standard Kaye I/O report (1-4) that is supplying the trend data. We recommend that you accept the default, which is Report 4. Press ENTER and the Auto-Trend screen appears.



General Parameters

In the top half of the screen, specify the timer that generates the report, buffering parameters, number of trends, rows of channel data to be included in the report, and text addresses of the Start-of-Text message, End-of-Text message, Date/Time message and the first of four consecutive header messages defining the first trend.

Individual Trends

In the bottom half of the screen, define up to 9 individual trends. Specify the format, live and historical triggers, and the relative addresses (01-32) of the channels supplying the data. Scroll the trends with PG DN and PG UP. Press ALT-P to save a trend and continue, or ESC to save and exit.

Press ALT-S for screen help, ALT-F1 for item help, and ALT-K for help with Kaye I/O operation. For detailed information on Auto-Trending, see the *Kaye I/O Reference* section.

Using a Template

To copy parameters from one individual trend to another, press ALT-T for a template and follow the prompts.

4. Calibration

Before you perform a validation study, you need to calibrate the temperature sensors to correct raw temperature readings to a NIST-traceable temperature measurement standard. The Programmer provides both a pre-test calibration and a post-run calibration check. The Programmer can control the entire calibration procedure, evaluating stability and deviation, sending the calibration values to the Kaye I/O hardware and generating the required documentation. Additionally, if a Kaye temperature reference is connected, the program automatically sets the temperature setpoints. This section explains the following subjects:

- Calibration references
- Temperature references
- Setup
- Calibration documentation
- Calibration procedures

Overview

Good Manufacturing Practices (GMP) state that the accuracy of a complete validation system must meet the temperature criteria of 0.5°C. Total system accuracy includes the sensor, the circuit and the recorder. Depending on the quality of the wire, the sensors alone may exceed the criteria. Sensor calibration is an operation that automatically corrects raw temperature sensor readings to a NIST-traceable temperature standard to compensate for any errors inherent in sensor materials. The calibration cycle supports the calibration of up to 32 sensors at two temperatures.

To perform a fully automated sensor calibration you'll need:

- Kaye HTR-400 or LTR-50 Drywell Calibrator temperature reference
- Kaye Intelligent RTD probe (IRTD) temperature standard
- Kaye I/O hardware
- Computer with The Programmer (rev 3.1x)

As part of the calibration procedure, the sensors and the temperature standard are placed into the temperature reference. The temperature reference provides a stable temperature with which to calibrate the sensors. The NIST-traceable temperature standard accurately measures the temperature of the reference.

The Programmer determines the stability and deviation of the sensors and temperature standard, and then downloads the calibration values for each sensor to the Kaye I/O hardware. Stability is the amount of change that is acceptable over a specific time frame and deviation is the difference in temperature between the sensor values and the temperature standard.

The Programmer is able to carry out a completely automated calibration. If it detects that there is a Kaye Intelligent RTD probe (IRTD) and a Kaye HTR-400, LTR-50 or HTR-600 temperature reference connected, The Programmer can automatically set the reference to specific setpoint and optionally perform a three-point calibration.

The Programmer produces reports that contain the information from the calibration. The reports can be printed locally, at intervals after each calibration point, and/or you can print a summary of the data once the entire calibration cycle is complete. The summary contains all of the information that is contained in the locally printed reports.

For a step-by-step overview of the calibration process, refer to Table 4-1.

Temperature measurement standards

During the calibration, The Programmer automatically corrects each sensor to read the same value as the temperature standard. This standard can be a Kaye Intelligent RTD probe, another independent standard, or a Digi channel. When an Intelligent RTD probe and a Kaye HTR/LTR temperature reference are used, the calibration can be fully automated and completely controlled by The Programmer.

Intelligent RTD Probe

The Kaye Intelligent RTD Probe is a self contained precision temperature measurement standard that communicates directly with your computer. Measurement accuracy is NIST-traceable to 0.01°C or 0.025°C (depending on the model). During the calibration process, The Programmer reads the value of the temperature reference with the IRTD probe.

While only one IRTD probe is normally connected, if you want to compare the readings from more than one probe, The Programmer has the ability to communicate with up to three IRTD probes.

See *Setup Probe* in this section for instructions on addressing Intelligent RTD Probes.

Manual Value

If the temperature standard that you are using is not a Kaye Intelligent RTD Probe, you must read the value of your standard and enter it manually. For example, if you have an RTD monitor with a NIST-traceable RTD, enter the value measured by this device as the temperature reference.

Digi Channel Value

Consult Kaye's Pharmaceutical Sales Support Engineering group for details.

Temperature references

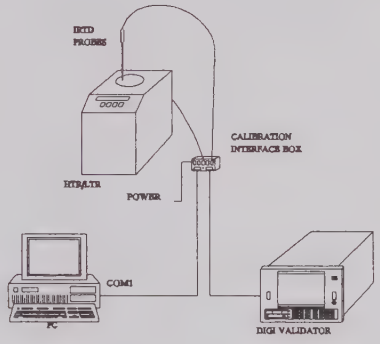
Temperature references provide the stable temperature required for sensor calibration. Kaye Instruments offers two models for validation use: the Kaye HTR-400 with a temperature range of 50 to 400°C and the Kaye LTR-50 with a temperature range of -25 to 80 °C.

The HTR-400 is recommended for two or three-point calibrations for sensors used in steam autoclaves, dry heat ovens and tunnel sterilizers. The LTR-50 is recommended for calibrations of sensors used in freezers, cold rooms and incubators.

The HTR/LTR temperature references communicate directly with The Programmer via the Kaye Calibration Interface box. You specify the Low, High and Mid-point temperatures and during the calibration the program automatically sets the temperatures at the reference allowing for a fully automated calibration.

Note: Other temperature references can be used to perform a calibration, however the automatic setting of the temperature is only available with the Kaye HTR and LTR temperature references and the Kaye Intelligent RTD probe. Other temperature references will not perform as well due to large stem conduction errors and/or well-to-well uniformity variations.

Table 4-1. The calibration process

1 Set up Equipment - Temperature Reference - Temperature Standard - Sensors - Computer - Kaye I/O unit - Calibration Interface Pages 4-8 to 4-10	
2 Select Calibration Pages 4-14 to 4-15	Start The Programmer, select Calibration, Pre-test Calibration, and then Low, High, or Low & High
3 Define calibration parameters Pages 4-16 to 4-18	Range of channels Temperature standard Sensor stability and deviation criteria Report interval and duration Temperature reference setpoints (low, high and/or mid-point) The parameters are saved for the next calibration.
4 Start calibration Page 4-19	Press PGDN. Programmer sets HTR/LTR to low setpoint.
5 Stability evaluation Pages 4-19 to 4-20	Using specified criteria, The Programmer determines the stability of the sensors and temperature standard.
6 Deviation evaluation Pages 4-20 to 4-21	Using specified criteria, The Programmer determines the deviation of the sensors from the temperature standard.

7 Calibration values to Kaye I/O Page 4-22	The Programmer sends calibration values to Kaye I/O unit; saves low point calibration data and calibration values to the Calibration Summary Report file.
8 Print corrected results Pages 4-22 to 4-23	The Programmer displays the corrected results, and the Kaye I/O unit prints them on its internal printer at the interval specified in step 3. Corrected results reports are also saved in the Calibration Summary Report file.
9 High point calibration	The Programmer sets HTR/LTR to high setpoint and repeats steps 5, 6, 7 and 8.
10 Mid-point check	The Programmer sets HTR/LTR to mid-point setpoint and repeats steps 5, 6 and 8. The mid-point check is performed on corrected values, and no calibration values are sent to the Kaye I/O.
11 Print Calibration Summary Report (PC) Page 4-26	At the end of the calibration cycle, you can print the Calibration Summary Report via LPT1 or view on your PC. The report contains the results of the low, high and mid-point calibrations as well as the corrected results reports.

Setup

This section explains how to:

- Connect the Kaye I/O, PC, IRTD and temperature reference
- Set up the IRTD probe
- Insert the sensors and IRTD probe into the temperature reference

Connecting the Kaye I/O, PC, IRTD and temperature reference

The Kaye Calibration Interface box, supplied with the Kaye IRTD probe, interfaces between your PC and the Kaye I/O, Intelligent RTD Probes and an HTR/LTR temperature reference. The calibration interface acts as a "hub" for connecting the equipment necessary to perform a sensor calibration, eliminating excess wiring. See *Figure 4-1.*

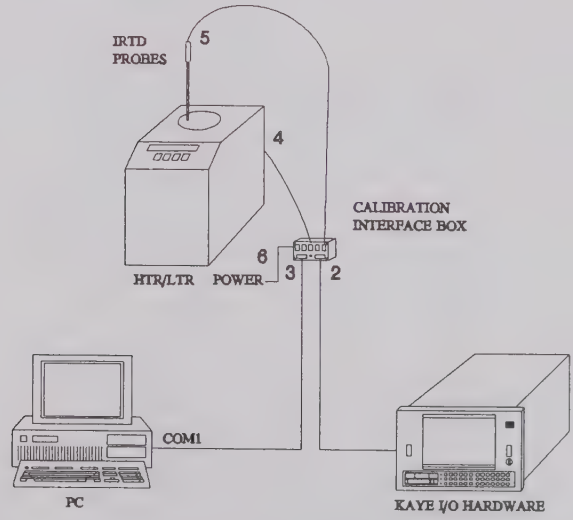


Figure 4-1. Complete calibration system

Figure 4-1 assumes that the Kaye Calibration Interface is used. The Calibration Interface is supported with version 3.1x of The Programmer.

To set up your complete validation system:

1. The Kaye Calibration Interface box is supplied with a velcro strip. We recommend that you mount the Kaye Calibration Interface box to your HTR/LTR temperature reference with the velcro.
2. Use the 9 to 25 pin cable supplied with the Kaye I/O to connect the 25 pin RS-232 port on the Kaye I/O to the Digi/Val connector on the Calibration Interface box. Tighten the thumb screws on the connections.
3. Use the 9 to 9 pin cable supplied with the Calibration Interface box to connect the COM1 port on your computer to the PC port on the interface. Tighten the thumb screws on the connections.
4. Use the Communications Cable supplied with your HTR/LTR to connect the 9 pin RS-232 port on the HTR to one of the modular jacks (RJ11) on the Calibration Interface box. Tighten the thumb screws on the 9 pin connector.
5. Connect up to three probes to the modular jacks (RJ11) on the Calibration Interface box.
6. Connect the AC power adaptor (Model M2831) supplied with the IRTD probe to any of the modular jacks and verify that the LED is on.

Setup probe

The Setup Probe selection lets you set the address of an IRTD probe. The IRTD probe is shipped from the factory with its address set to 01. If you are using more than one probe, each probe must have a unique address of 01, 02, or 03. Once the address is set, it is not necessary to carry out this operation on subsequent calibration with the same probe. Connect only one probe at a time when you are setting the address. After setup, you can connect up to three probes in a multi-drop configuration.

Sensor installation

The Kaye HTR/LTR temperature references are shipped with thermocouple inserts. Failure to use these inserts will result in significant calibration errors. If you are using RTDs, remove the thermocouple inserts and replace with inserts that are suitable. Contact Kaye Instruments for available inserts.

- Insert the IRTD probe into one of the reference wells. The probe should fit snugly, but still be easily removed. Avoid any dirt or grit that may cause the probe to jam into the well. Insert the IRTD probe the full six inch depth.
- Insert the sensors into the calibration wells. Up to three type T Teflon or Kapton thermocouples or a single RTD fit into each well.
- If you are using an LTR-50 temperature reference: to load the sensors, grasp the nylon ball on the end of the insert and raise until approximately one (1) inch shows above the edge of the well. Fit the thermocouples into the grooves in the insert. Lower the insert and slide the thermocouples down until they reach the bottom of the well.

How a calibration operates

The calibration should be performed in the same temperature environment as the equipment being validated whenever possible. This eliminates any possible errors due to temperature changes in the system. There are three types of calibrations that can be performed depending on your application: a one-point, a two-point or a three-point. If the equipment is used in a dynamic temperature environment, such as a steam sterilizer, perform a two or three-point calibration (the third point is the mid-point check). If the equipment is used in a static process, such as an incubator or cold room, a one-point calibration may be sufficient.

When an HTR/LTR temperature reference and Intelligent RTD probe are part of your hardware configuration, the pre-test calibration offers an automatic two or three-point calibration process. A three-point calibration includes calibration at both low and high temperatures and a mid-point check to verify that your sensors are within acceptable limits at a point between the specified temperatures. For example, if you are performing a calibration using a steam sterilizer, the low calibration would be performed at 90°C, the high temperature at 125°C, and the mid-point check would be performed at 121°C.

The pre-test calibration is normally performed prior to validation studies. At the Pre-test Calibration screen you select either a Low, High or Low & High calibration and are prompted to enter the setpoints for the HTR/LTR, define the acceptance criteria and configure the calibration reports.

Once pre-test calibration has been configured, the program verifies that all sensors, the temperature reference and the temperature standard are stable. The acceptance criteria that you specified is used by

The Programmer to automatically verify the temperature stability of the sensors. In addition, the Kaye IRTD probe has a fixed stability criteria that must also be met to successfully complete the stability evaluation.

During the deviation check, each sensor is compared to the temperature standard and sensors that are outside the specified deviation are eliminated from the calibration. The Programmer then sends the calibration values to the Kaye I/O hardware.

A post-run calibration check is normally performed after the validation studies to verify that the sensors are still within specifications from the pre-test calibration. The post-run calibration check is only performed at one temperature; normally at the mid-point or the high.

Calibration documentation

The Programmer produces two types of calibration documentation: corrected results reports and calibration summary reports. The corrected results reports are printed at the end of each calibration point at specified intervals. The Digistrip prints these reports on its internal printer; an external printer is required to print them at the DigiLink. However, since the same data is included in the Calibration Summary Report, you may want to print or view the data when the calibration cycle is complete.

The Calibration Summary Report is created by The Programmer at the end of the calibration cycle and is stored at the PC. It contains a snapshot of the entire calibration cycle and all of the corrected results reports. It can be displayed or printed via LPT1 at the end of the calibration cycle.

Corrected Results Reports

After each calibration point, the Kaye I/O hardware prints reports showing the corrected results for the range of channels you specified for calibration. They also include the reference value with its channel address. Refer to Figure 4-2 for sample corrected results reports.

Calibration Summary Report

This report contains the time and date of the calibration, the temperature setpoints, the probe information, the acceptance criteria, the temperature readings from the Stability and Deviation evaluations, a summary of the uncalibrated channels, and the corrected results printed at the specified interval. Refer to Figure 4-3 for a sample Calibration Summary Report.

There are two utilities that allow you to print and view the Calibration Summary Report. The Calibration Summary Report can be printed to the PC's printer at any time after the completion of the calibration cycle by selecting Print Calibration Summary Files. View Calibration Summary Files allows you to look at the report to verify that your calibration was completed successfully and it is acceptable to proceed with your studies. The on-screen report can be archived and printed at a later time. See *Calibration Summary Reports*, for the procedures. You specify the report filename when you set up the calibration parameters. These files are saved with the extension .RPT. Reports for successive calibrations using the same filename will be appended. For security purposes, these files are not automatically deleted. Use the DOS commands to archive and delete the files.

For ease of viewing and printing the results of the last calibration cycle, a file called CALIB.RPT is available. This file contains the calibration summary report from the last calibration cycle. New calibration data overwrites the previous calibration data. If you are interested in viewing or printing only the last Calibration Summary Report, select CALIB.RPT from the list of Calibration Summary Reports.

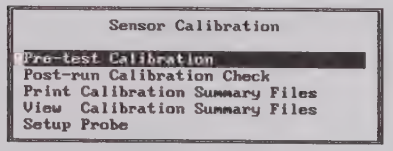
Performing a calibration

Performing a calibration involves the following steps:

- Specify the calibration parameters
- The calibration process
- Calibration check after the validation study
- Calibration Summary Reports

Specify the calibration parameters

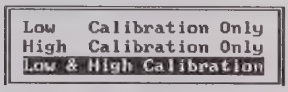
At the Main menu select Calibration and enter an operator password if required. The Sensor Calibration sub-menu appears that allows you to select Pre-test Calibration, Post-run Calibration Check, Print Calibration Summary Files, View Calibration Summary Files or Setup Probe.



To begin your calibration, select Pre-test Calibration.

At the file selection screen, select the name of the file loaded at the Kaye I/O harware. The Programmer verifies that the program file selected for calibration matches the program loaded in the Kaye I/O hardware.

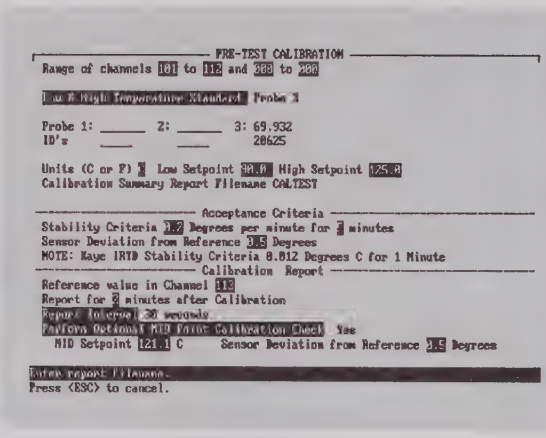
At the Pre-test Calibration screen, select the mode of calibration. Low & High Calibration is only available if you are using a Kaye HTR/LTR and an Intelligent RTD Probe.



If an HTR/LTR is not detected, this selection appears in red. If you have a Kaye HTR/LTR and the IRTD probe connected to your system and the menu selection Low & High appears in red, check your cabling. If all cables are properly connected, make sure the HTR/LTR is in the correct mode and displaying the well temperature. Press the EXIT key on the HTR/LTR until the well temperature appears in the display window of the instrument. Exit The Programmer and restart the calibration.

If you specify a Low & High Calibration, the low calibration is performed first. After the high calibration is complete, The Programmer carries out an optional mid-point check to verify that the sensors have not changed. If you are doing a two-point calibration without using the Low & High Calibration option, you must perform the low calibration first. Then return to the menu and perform the high calibration.

The values entered at the Pre-test Calibration screen are saved as the default for the next calibration. This eliminates the need to re-enter data each time a calibration is performed.


PRE-TEST CALIBRATION
Range of channels 101 to 112 and 000 to 000
Low & High Temperature Standard Probe 3
Probe 1: _____ 2: _____ 3: 69.932
ID's ____ ____ 28625
Units (C or F) F Low Setpoint 32.0 High Setpoint 125.0
Calibration Summary Report Filename CALTEST
Acceptance Criteria
Stability Criteria 1.7 Degrees per minute for 3 minutes
Sensor Deviation from Reference 3.5 Degrees
NOTE: Kaye IRTD Stability Criteria 0.012 Degrees C for 1 Minute
Calibration Report
Reference value in Channel 113
Report for 2 minutes after Calibration
Report Interval 30 seconds
Perform Optional MID Point Calibration Check Yes
MID Setpoint 121.1 C Sensor Deviation from Reference 3.5 Degrees
Enter report filename.
Press <ESC> to cancel.

Range of channels. Specify up to 32 channels to calibrate. These channels can be in two ranges, such as 101 to 112 and 201 to 212. All channels within the range must have thermocouple or RTD functions programmed. To ignore the second range, enter 000 to 000.

Temperature standard. Specify the source of the temperature standard - a Kaye Intelligent RTD probe or a Digi channel - or enter the reference temperature manually.

The program automatically detects if an IRTD probe is present. If you have an IRTD probe connected and the selection appears in red, check your cabling. Up to three probes, addressed 01, 02 and 03, may be connected to your PC via the Kaye Calibration Interface.

Temperature reference setpoint. Specify temperature units in degrees C or F and enter the low and/or high setpoint for the temperature reference. The following are the setpoint ranges for the HTR/LTR temperature references:

	LTR-50	*HTR-400*	*HTR-600*
Min	-35	25	25
Max	140	400	600

Calibration Summary Report Filename. Enter a filename for the Calibration Summary Report or accept the default name. If the file already exists, the new information is appended. The Calibration Summary Report file contains the data from the calibration and can be viewed or printed at any time after the complete calibration cycle.

Stability Criteria Degrees per minute for n minutes. Enter the maximum temperature rate (0.1°C to 0.9°C) for the amount the sensor readings and the reference can vary during an interval of 3 to 9 minutes. If you are using a Kaye HTR/LTR and an IRTD probe, the recommended stability criteria is 0.2°C per minute for 5 minutes. In addition, if you are using a Kaye IRTD, the temperature of the IRTD probe must not have changed more than 0.012°C for one minute. If you are using a Kaye HTR/LTR, the probe temperature must be within 3.0°C of the setpoint. If the temperature reference is adjusted either automatically or manually, the IRTD probe settles after the sensors.

If you want to disable automatic calibration, enter "M" for Manual mode. You will be brought to the Deviation screen when you press PGDN. You then control the calibration process by comparing the readings to the reference for acceptable stability and deviation and pressing ENTER.

Sensor Deviation from Reference Degrees. Enter the allowable deviation in degrees (0.1°C to 9.9°C) between the sensors and the temperature standard. Because The Programmer compares uncorrected values to the temperature standard, you should take into account the potential errors from the sensor, temperature reference and temperature standard when defining this value. If you are using Kaye wire and calibration equipment, the recommended minimum value is 0.3°C.

The following selections are used to format the corrected results reports:

Reference value in Channel. Enter the address of the Kaye I/O channel that will store the value of the temperature standard. This channel must be programmed with a Skip function. When possible, put the reference value in the same row as the sensor data.

Report for n minutes after calibration. Enter the length of time (1 to 9 minutes) that you would like the Kaye I/O to print corrected results after each calibration point is completed. The same sensor data is also included in the Calibration Summary file. The format is fixed at 16 channels per line.

Report interval. Select the number of seconds between corrected results reports (20, 30 or 60).

Perform Optional Mid Point Calibration Check. This option is only available if you are performing a High & Low Calibration. If you select Yes, the Mid-Point Check screen will be displayed.

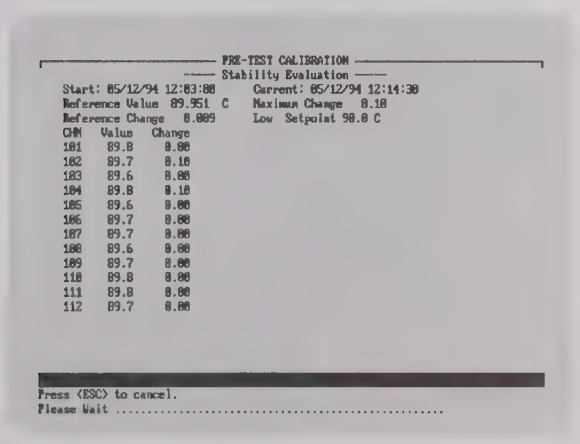
Two parameters can be specified: the mid-point setpoint and the allowable deviation. Deviation for the mid-point check is normally much tighter than the pre-test calibration since you are looking at corrected results.

The calibration process

Press PGDN to start the calibration. The calibration process can be cancelled at any time by pressing ESC, restoring the Kaye I/O to its original values. Once the calibration process is started, The Programmer carries out three basic steps: the stability evaluation, the deviation evaluation and corrected results.

Stability Evaluation

When the Stability Evaluation screen appears all channels and the reference value are marked with asterisks, indicating that they are not yet stable.



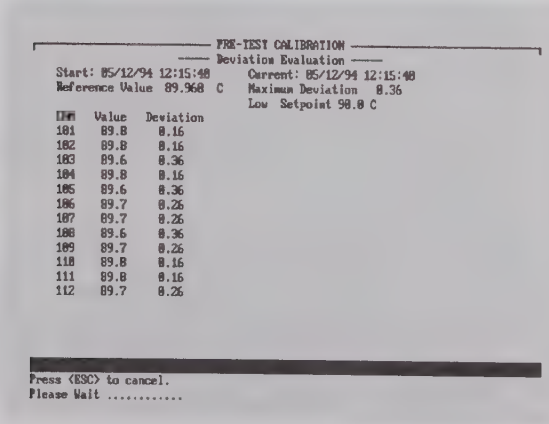
The program gathers and displays uncorrected sensor readings every 10 seconds. After one minute, and every minute thereafter, the calculated change in temperature readings is displayed. Also displayed is the setpoint of the temperature reference.

The program compares the change in temperature readings to the stability criteria that you specified to determine when the sensors are stable. If you are using a Kaye Intelligent RTD probe as part of your calibration system, stability cannot be reached until the program also determines that the temperature of the probe has not changed by more than 0.012°C in the last minute. If you are using an HTR/LTR, the temperature reference must be within 3.0°C of the setpoint. If a sensor is OPEN, it is disregarded during the stability evaluation.

When stability is reached, the asterisks disappear and The Programmer saves the values on the screen and the time stability was achieved to the Calibration Summary Report. The program then proceeds to the deviation evaluation.

Deviation Evaluation

The Deviation Evaluation screen appears next.

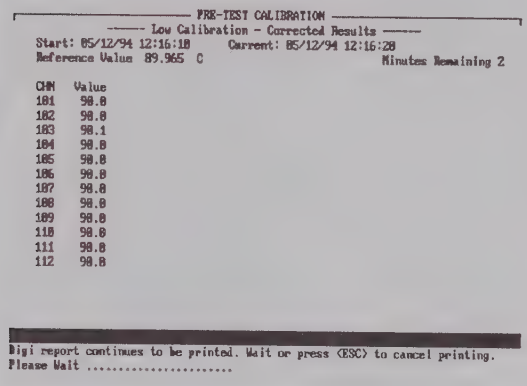


Ten seconds into the deviation evaluation, The Programmer gathers the sensor readings and compares them with the temperature reported by the temperature standard. The deviation values appear on the screen and are displayed for another ten seconds. The deviation values indicate the maximum deviation of each sensor from the standard. The Programmer then performs the calibration and saves the displayed values in the Calibration Summary Report. The Calibration Summary Report indicates the channels that did not meet the deviation criteria and were not calibrated. (See *Calibration Summary Report* at the beginning of this section). If a sensor is OPEN, it is not calibrated. Uncalibrated channels are forced to read 6553.5 or 655.35, depending on the resolution of the thermocouple or RTD being calibrated. Prior to validation studies, sensors that failed calibration should be disconnected from the system.

If you selected a Low & High Calibration and a channel is excluded during the low calibration, it is ignored during the high calibration.

Corrected Results

At the end of each calibration point, the corrected results are displayed on the screen for the period of time specified for printing corrected results.



After printing the corrected results, The Programmer moves to the next setpoint and repeats the procedure. If you specified a Low & High Calibration, an optional mid-point check is then carried out automatically by The Programmer. The corrected results reports are also included in the Calibration Summary Report.

```
                                LOW CALIBRATION REPORT - CORRECTED RESULTS
05/12/94 12:16:40 BPA AUTOCLAVE1 DF1234 D4VALP
  101     102     103     104     105     106     107     108     109     110     111     112     113
DTEMP 1 DTEMP 2 DTEMP 3 DTEMP 4 DTEMP 5 DTEMP 6 DTEMP 7 DTEMP 8 DTEMP 9 DTEMP 10DTEMP 11DTEMP 12REF20625
 90.0C   90.0C   90.1C   90.0C   90.0C   90.0C   90.0C   90.0C   90.0C   90.0C   90.0C   90.0C  89.96

                                LOW CALIBRATION REPORT - CORRECTED RESULTS
05/12/94 12:17:10 BPA AUTOCLAVE1 DF1234 D4VALP
  101     102     103     104     105     106     107     108     109     110     111     112     113
DTEMP 1 DTEMP 2 DTEMP 3 DTEMP 4 DTEMP 5 DTEMP 6 DTEMP 7 DTEMP 8 DTEMP 9 DTEMP 10DTEMP 11DTEMP 12REF20625
 90.0C   90.0C   90.0C   90.0C   90.0C   90.0C   90.0C   90.0C   90.0C   90.0C   90.0C   90.0C  89.97
```

```
                               HIGH CALIBRATION REPORT - CORRECTED RESULTS
05/12/94 12:40:40 BPA AUTOCLAVE1 DF1234 D4VALP
  101     102     103     104     105     106     107     108     109     110     111     112     113
DTEMP 1 DTEMP 2 DTEMP 3 DTEMP 4 DTEMP 5 DTEMP 6 DTEMP 7 DTEMP 8 DTEMP 9 DTEMP 10DTEMP 11DTEMP 12REF20625
 125.0C  124.9C  124.9C  125.0C 6553.5C  125.0C  125.0C 6553.5C  124.9C  125.0C  125.0C  125.0C 125.02

                               HIGH CALIBRATION REPORT - CORRECTED RESULTS
05/12/94 12:41:10 BPA AUTOCLAVE1 DF1234 D4VALP
  101     102     103     104     105     106     107     108     109     110     111     112     113
DTEMP 1 DTEMP 2 DTEMP 3 DTEMP 4 DTEMP 5 DTEMP 6 DTEMP 7 DTEMP 8 DTEMP 9 DTEMP 10DTEMP 11DTEMP 12REF20625
 125.0C  124.9C  124.9C  125.0C 6553.5C  124.9C  125.0C 6553.5C  124.9C  125.0C  125.0C  124.9C 125.01
```

```
                                POST CALIBRATION REPORT - CORRECTED RESULTS
05/12/94 12:55:40 BPA AUTOCLAVE1 DF1234 D4VALP
  101     102     103     104     105     106     107     108     109     110     111     112     113
DTEMP 1 DTEMP 2 DTEMP 3 DTEMP 4 DTEMP 5 DTEMP 6 DTEMP 7 DTEMP 8 DTEMP 9 DTEMP 10DTEMP 11DTEMP 12REF20625
 121.0C  120.9C  120.9C  121.0C 6553.5C  121.0C  121.0C 6553.5C  120.9C  121.0C  121.0C  120.9C 121.02

                                POST CALIBRATION REPORT - CORRECTED RESULTS
05/12/94 12:56:10 BPA AUTOCLAVE1 DF1234 D4VALP
  101     102     103     104     105     106     107     108     109     110     111     112     113
DTEMP 1 DTEMP 2 DTEMP 3 DTEMP 4 DTEMP 5 DTEMP 6 DTEMP 7 DTEMP 8 DTEMP 9 DTEMP 10DTEMP 11DTEMP 12REF20625
 121.0C  120.9C  120.9C  121.0C 6553.5C  121.0C  121.0C 6553.5C  120.9C  121.0C  121.0C  120.9C 121.03
```

Figure 4-2. Sample Corrected Results Report

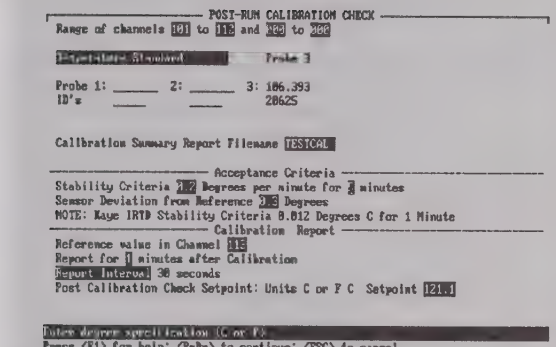
When the entire calibration process is finished, you are prompted, "Calibration is complete. Assure corrected results reports have printed at the Kaye I/O before you press P or ESC. Press P to print Summary, save file and exit; ESC to save file and exit." Your computer will optionally beep, depending on how your program was installed, until you choose to print or escape.

> *Note: If the corrected results reports did not print because the printer ran out of paper or was off-line, correct the problem at the printer and allow the corrected results reports to complete before pressing P or ESC.*

If you do not have a printer with you, press ESC to save the report and print it later using the Print Calibration Summary Files selection.

Calibration Check After the Validation Study

After validation studies, you may choose to perform a post-run calibration check. A post-run calibration check includes checking sensors at a temperature, normally the high or mid-point. Select Post-run Calibration Check from the Sensor Calibration menu if you wish to verify that the sensors are still within specifications.


POST-RUN CALIBRATION CHECK
Range of channels 101 to 115 and 201 to 206
Probe 1: _____ 2: _____ 3: 186.393
ID's ____ ____ 2862S
Calibration Summary Report Filename TESTCAL
Acceptance Criteria
Stability Criteria 0.2 Degrees per minute for 3 minutes
Sensor Deviation from Reference 2.5 Degrees
NOTE: Kaye IRTD Stability Criteria 0.012 Degrees C for 1 Minute
Calibration Report
Reference value in Channel 115
Report for 5 minutes after Calibration
Report Interval 30 seconds
Post Calibration Check Setpoint: Units C or F C Setpoint 121.1
Press <F1> for help; <PgDn> to continue; <ESC> to cancel.

The post-run calibration check is only performed at a single temperature. The Programmer performs all aspects of the calibration process except the calibration values entered during the pre-test calibration are not changed, instead the program displays and records the corrected sensor values. Configure the Post-run Calibration Check screen the same way you did the Pre-test Calibration screen.

Calibration Summary Reports

Select Print Calibration Summary Report Files from the Sensor Calibration menu to print Calibration Summary Report files stored during previous calibrations. At the completion of the pre-test calibration, if you wish to determine if a calibration was performed correctly and you do not have a printer available, select View Calibration Summary Report Files.

Select the name of the stored Calibration Summary Report that you would like to print or view and press ENTER.

In the Calibration Summary Report, the sensor values that appear in the Deviation Evaluation section are the actual uncorrected values that are sent to the Kaye I/O. The Deviation value represents the sensors maximum deviation from the standard. The numbers that appear in the Calibration Report - Corrected Results section are the corrected temperature readings. The Probe Cal Information field displays the calibration lab and the date of calibration of the Intelligent RTD probe.

To print. Print the selected Calibration Summary Report to a parallel printer attached to your computer's parallel printer port (LPT1). See Figure 4-3 for a sample of a Calibration Summary Report.

To view. You can scroll through the Calibration Summary Report using the →, ←, ↑, and ↓ keys. To return to the top of the file press the HOME key and to return to the end of the file press the END key.

Figure 4-3 illustrates a Calibration Summary Report containing the time and date of the calibration, the temperature setpoints, the probe information, the acceptance criteria, the temperature readings from the Stability and Deviation evaluations, a summary of the uncalibrated channels, and the corrected results for each calibration setpoint.

********** High Calibration Summary Report **********

Filename: CALTEST Test Identifier - BPA AUTOCLAVE1 DF1234 D4VALP

Range of channels 101 to 112 High Temperature Standard - Probe ID 20625
and 000 to 000 Probe Cal Information

Setpoint 125.0 C

***** Acceptance Criteria *****

Stability 0.2 Degrees for 5 minutes
Sensor Deviation from Reference 0.5 Degrees

***** Calibration Report Parameters *****

Reference value in Channel 113
Report Interval 30 seconds Report for 2 minutes after Calibration

***** Stability Evaluation *****

Start Time 05/12/94 12:18:50 Time of Stability 05/12/94 12:39:50
Reference Value 125.027 Maximum Change 0.10
Reference Change 0.009

Chn	Value	Change	Chn	Value	Change	Chn	Value	Change	Chn	Value	Change
101	124.7	0.00	102	124.7	0.00	103	124.5	0.10	104	124.7	0.00
105	124.5	0.00	106	124.6	0.00	107	124.6	0.00	108	124.5	0.10
109	124.7	0.00	110	124.7	0.00	111	124.7	0.00	112	124.7	0.00

***** Deviation Evaluation *****

Start Time 05/12/94 12:40:00 Time of Conformity 05/12/94 12:40:00
Reference Value 125.024 Maximum Deviation 0.52

Chn	Value	Dev	Chn	Value	Dev	Chn	Value	Dev	Chn	Value	Dev
101	124.7	0.32	102	124.7	0.32	103	124.6	0.42	104	124.7	0.32
105	124.5	0.52	106	124.6	0.42	107	124.6	0.42	108	124.5	0.52
109	124.7	0.32	110	124.7	0.32	111	124.7	0.32	112	124.7	0.32

***** Summary of Uncalibrated Channels *****

105 108

Figure 4-3. Sample Calibration Summary Report

```
***** Calibration Report - Corrected Results *****

05/12/94 12:40:40 BPA AUTOCLAVE1 DF1234 D4VALP
101  125.0  102  124.9  103  124.9  104  125.0  105 6553.5  106  125.0
107  125.0  108 6553.5  109  124.9  110  125.0  111  125.0  112  125.0
REF 125.02

05/12/94 12:41:10 BPA AUTOCLAVE1 DF1234 D4VALP
101  125.0  102  124.9  103  124.9  104  125.0  105 6553.5  106  124.9
107  125.0  108 6553.5  109  124.9  110  125.0  111  125.0  112  124.9
REF 125.01

05/12/94 12:41:40 BPA AUTOCLAVE1 DF1234 D4VALP
101  125.0  102  124.9  103  124.9  104  125.0  105 6553.5  106  124.9
107  125.0  108 6553.5  109  124.9  110  125.0  111  125.0  112  124.9
REF 125.01

05/12/94 12:42:10 BPA AUTOCLAVE1 DF1234 D4VALP
101  125.0  102  124.9  103  124.9  104  125.0  105 6553.5  106  124.9
107  125.0  108 6553.5  109  124.9  110  125.0  111  125.0  112  124.9
REF 125.01

05/12/94 12:42:40 BPA AUTOCLAVE1 DF1234 D4VALP
101  125.0  102  124.9  103  124.9  104  125.0  105 6553.5  106  124.9
107  125.0  108 6553.5  109  124.9  110  125.0  111  125.0  112  124.9
REF 125.00
```

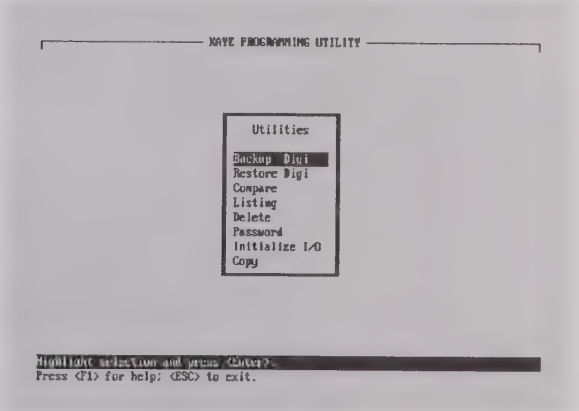
Figure 4-3 continued. Sample Calibration Report

5. Utilities

When you are in the Utilities mode, you can save an entire Kaye I/O program or portions of it to a disk file. You can also use the utilities to load (restore) a program to a Kaye I/O unit, copy a program, compare a program with a current Kaye I/O program, generate a hard copy listing of a program, define a password, and initialize the Kaye I/O unit.

The following operations are Supervisor password protected: Backup, Delete, Password, Initialize, Copy

The following operations are Operator password protected: Restore, Compare, Listing



Key Commands

ALT-F1	- Item help
ALT-F2	- Print miscompare file
ESC	- Exit
F1	- Screen help
F2	- Display miscompare file
F8	- Start

Backup

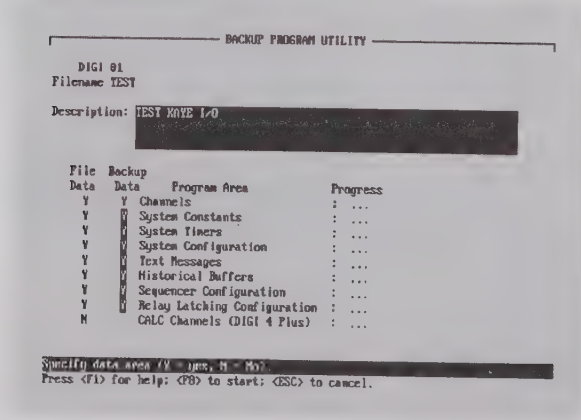
The Backup utility copies the current Kaye I/O program, or the portions you select, to a file. When you enter the Backup utility, a list of program files appears, and you are prompted for a file name. Enter a name of up to eight characters or select a name from the list of files. If you select an existing file to backup, the backup procedure overwrites the contents of the file with the new program.

Direct connection

A display of Kaye I/O program files appears, and you are prompted for a file name. Enter a name of up to eight characters or select a name from the list. The Backup screen appears.

KVIEW environment

When you select Backup, a list of Kaye I/O units appears, and you are prompted for the ID of the unit you want to back up. When the list of files appears, proceed as above.


BACKUP PROGRAM UTILITY
DIGI 01
Filename TEST
Description: TEST KAYE I/O
File Data
Backup Data
Program Area
Progress
Y Y Channels : ...
Y Y System Constants : ...
Y Y System Timers : ...
Y Y System Configuration : ...
Y Y Text Messages : ...
Y Y Historical Buffers : ...
Y Y Sequencer Configuration : ...
Y Y Relay Latching Configuration : ...
N CALC Channels (DIGI 4 Plus) : ...
Specific data area (Y = yes, N = No):
Press <F1> for help; <F8> to start; <ESC> to cancel.

On the Backup screen, previously backed up areas are indicated with a Y in the File Data column.

Description
Enter a file description of up to 3 lines of 60 characters. The description becomes a permanent part of the file.

Backup Data
Enter a Y at each programming area you want to back up. Be sure to leave the default N at all areas you do *not* want to overwrite.

Starting Backup

Press F8 to start. At the prompt, press ENTER to confirm the Backup request. A wait message appears, and the Progress field indicates the address being backed up.

Cancelling a Backup

Press ESC to cancel the Backup operation at any time. At the prompt, enter Y to return to the Main Menu. The file is deleted.

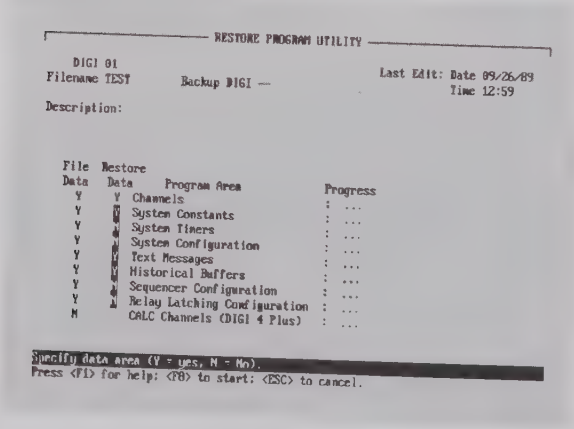
Restore

The Restore utility lets you load a complete file or portions of a file to a Kaye I/O unit. The file can be either a programming file or a backup. You can restore a program to the source Kaye I/O or to any Kaye I/O in the network.

NOTE: While a Restore is in progress, the Kaye I/O unit remains on line. Because it may be processing data on the basis of a partially restored program, be sure the unit is not transmitting any critical control signals.

At the prompts, enter the target unit ID (KVIEW environment only) and the file name.

The Restore data entry screen appears showing the Filename, Date and Time created or last edited, the Description, and a Y in the File Data column for each area that has been programmed.


RESTORE PROGRAM UTILITY
DIGI 01
Filename TEST
Backup DIGI —
Last Edit: Date 09/26/89
Time 12:59
Description:
File Data
Restore Data
Program Area
Progress
Y Y Channels : ...
Y Y System Constants : ...
Y Y System Timers : ...
Y Y System Configuration : ...
Y Y Text Messages : ...
Y Y Historical Buffers : ...
Y Y Sequencer Configuration : ...
Y Y Relay Latching Configuration : ...
N CALC Channels (DIGI 4 Plus) : ...
Specify data area (Y = yes, N = No).
Press <F1> for help; <F8> to start; <ESC> to cancel.

If you are restoring a Backup file, the ID of the source Kaye I/O is shown in the Backup Kaye I/O field.

Restore Data

Enter Y next to each program area you want to restore.

The various Kaye I/O models contain different functions. If you restore a program to a model that does not support all of the functions in that program, the Kaye I/O will reject the unsupported functions. Check the program for invalid references.

You can restore a Digi 4 Plus program to a standard Digi 4 by entering N next to CALC Channels.

After a Restore, you may have to update the reset times on your system timers.

Starting Restore

Press F8 to start. At the prompt, press ENTER to confirm the Restore request. The Programmer immediately initializes the Kaye I/O and displays a wait message. As addresses are restored, they are indicated in the Progress field.

Handling Errors

When you restore an Off-line Programming file, the Kaye I/O may reject some of the data. You are prompted, "Restore error. Data not accepted at Kaye I/O. Press <F8> to continue; <ESC> to cancel."

If you continue, The Programmer skips the current address and moves to the next address in the current programming area. Make a note of the skipped address, or run the Compare utility after the Restore so you know exactly what information is missing.

Cancelling

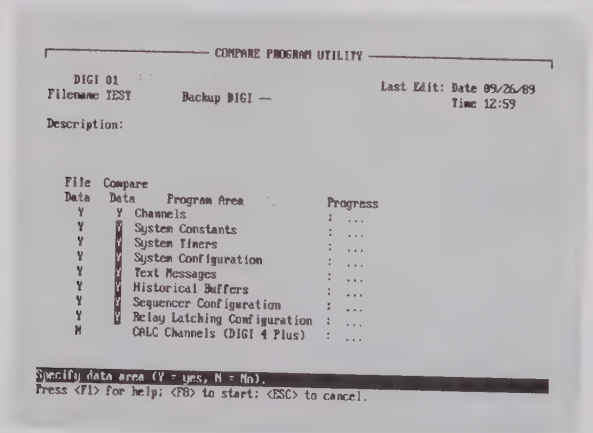
Press ESC at any time to cancel the Restore operation. This leaves the Kaye I/O database incomplete.

Compare

Select this utility to compare a current Kaye I/O database, or parts of it, to a file.

At the prompts, enter a unit ID (KVIEW environment only) and a file name.

The Compare screen shows the File name, the Backup Kaye I/O (source of the file), and the Date, Time and Description of the file.


COMPARE PROGRAM UTILITY
DIGI 01
Filename TEST
Backup DIGI —
Last Edit: Date 09/26/89
Time 12:59
Description:
File Data
Compare Data
Program Area
Progress
Y Y Channels : ...
Y Y System Constants : ...
Y Y System Timers : ...
Y Y System Configuration : ...
Y Y Text Messages : ...
Y Y Historical Buffers : ...
Y Y Sequencer Configuration : ...
Y Y Relay Latching Configuration : ...
N CALC Channels (DIGI 4 Plus) : ...
Specify data area (Y = yes, N = No).
Press <F1> for help; <F8> to start; <ESC> to cancel.

Compare Data

Enter Y next to each programming area you want to compare. The CALC Channels are accessible only if you are working with a Digi 4 Plus.

The Programmer does not compare inputs and outputs on channel data or reset times on system timers, because these fields contain live data or data that may have been updated since the file was created.

Starting Compare

Press F8. At the prompt, press ENTER to confirm the Compare request. A wait message appears, and as addresses are compared, they appear in the Progress column.

The number of miscompares in each area appears at the far right. The number increments with every database address that miscompares. Channel miscompares are counted as one, although several parameters may be involved.

Cancelling

Press ESC at any time to cancel the Compare.

Displaying and Printing

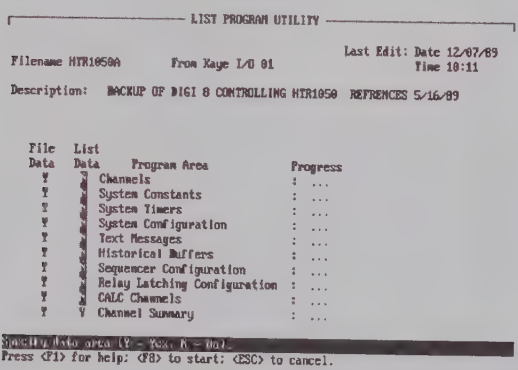
When the Compare is complete, press F2 to display the miscompare file. The first screen contains the information on the Compare data entry screen, and the following screens show miscompares organized by program area. For each address, you see the data in the file and the data at the Kaye I/O.

To print the miscompare file, press ALT-F2.

List Program

Select this utility to generate a hard copy of a Kaye I/O program.

At the prompt, enter a file name. The List Program data entry screen appears.



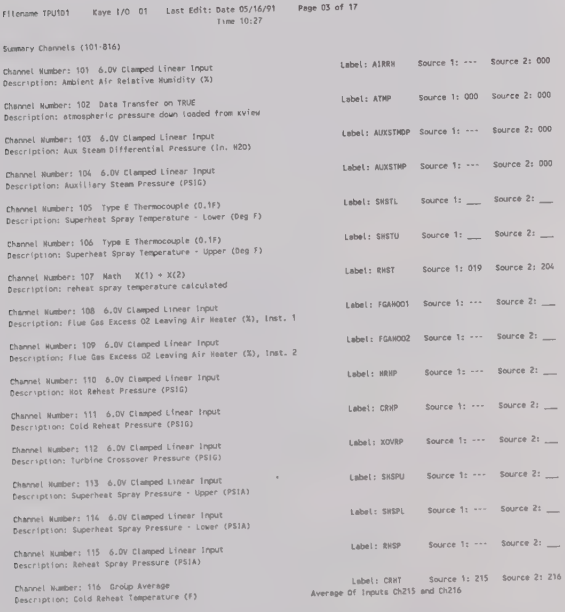
List Data

Enter a Y at any area that has been programmed. If you selected Channels or Calc Channels, specify the range of channels. If no range is entered, The Programmer defaults to 101 to 816 for Channels and 001 to 099 for Calc Channels. You cannot access unprogrammed areas.

Starting

Press F8 to start, and ENTER to confirm.

The Channel Summary, the final selection in the Program Area column, prints a Channel Map and a list of all the channels. There is also a line for each channel that indicates the values stored at the Input, Output and limit channels. Nonprogrammed channels display the Skip function. A page from a sample channel summary is shown below.



```
Filename TPU101     Keye I/O  01    Last Edit: Date 05/16/91     Page 03 of 17
                                          Time 10:27

Summary Channels (101-816)

Channel Number: 101  6.0V Clamped Linear Input                  Label: AIRRH     Source 1: ---   Source 2: 000
Description: Ambient Air Relative Humidity (%)

Channel Number: 102  Data Transfer on TRUE                      Label: ATMP      Source 1: 000   Source 2: 000
Description: atmospheric pressure down loaded from kview

Channel Number: 103  6.0V Clamped Linear Input                  Label: AUXSTMDP  Source 1: ---   Source 2: 000
Description: Aux Steam Differential Pressure (In. H20)

Channel Number: 104  6.0V Clamped Linear Input                  Label: AUXSTMP   Source 1: ---   Source 2: 000
Description: Auxiliary Steam Pressure (PSIG)

Channel Number: 105  Type E Thermocouple (0.1F)                 Label: SWSTL     Source 1: ___   Source 2: ___
Description: Superheat Spray Temperature - Lower (Deg F)

Channel Number: 106  Type E Thermocouple (0.1F)                 Label: SWSTU     Source 1: ___   Source 2: ___
Description: Superheat Spray Temperature - Upper (Deg F)

Channel Number: 107  Math   X(1) + X(2)                          Label: RWST      Source 1: 019   Source 2: 204
Description: reheat spray temperature calculated

Channel Number: 108  6.0V Clamped Linear Input                  Label: FGAN001   Source 1: ---   Source 2: ___
Description: Flue Gas Excess O2 Leaving Air Heater (%), Inst. 1

Channel Number: 109  6.0V Clamped Linear Input                  Label: FGAN002   Source 1: ---   Source 2: ___
Description: Flue Gas Excess O2 Leaving Air Heater (%), Inst. 2

Channel Number: 110  6.0V Clamped Linear Input                  Label: HRHP      Source 1: ---   Source 2: ___
Description: Hot Reheat Pressure (PSIG)

Channel Number: 111  6.0V Clamped Linear Input                  Label: CRHP      Source 1: ---   Source 2: ___
Description: Cold Reheat Pressure (PSIG)

Channel Number: 112  6.0V Clamped Linear Input                  Label: XOVRP     Source 1: ---   Source 2: ___
Description: Turbine Crossover Pressure (PSIG)

Channel Number: 113  6.0V Clamped Linear Input                  Label: SHSPU     Source 1: ---   Source 2: ___
Description: Superheat Spray Pressure - Upper (PSIA)

Channel Number: 114  6.0V Clamped Linear Input                  Label: SHSPL     Source 1: ---   Source 2: ___
Description: Superheat Spray Pressure - Lower (PSIA)

Channel Number: 115  6.0V Clamped Linear Input                  Label: RHSP      Source 1: ---   Source 2: ___
Description: Reheat Spray Pressure (PSIA)

Channel Number: 116  Group Average                              Label: CRHT      Source 1: 215   Source 2: 216
Description: Cold Reheat Temperature (F)                    Average Of Inputs Ch215 and Ch216
```

The Channel Summary is supported in compressed format on Epson compatible printers.

If you have another type of printer, download a small font size.

Delete

This utility lets you delete a backup or programming file from the system.

At the prompt, specify the file name. You are prompted to confirm the delete request.

Press Y to delete, or ESC to return to the Main Menu.

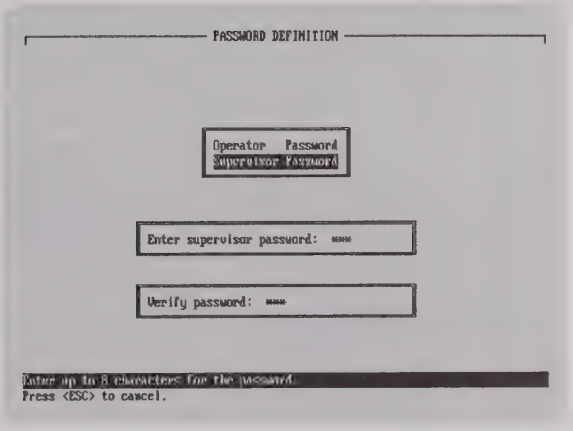
Password

Select the Password utility to enter operator and supervisor passwords.

The operator password restricts access to restore, compare and listing in the Utilities Menu and to the Calibration selection on the Main Menu.

The supervisor password restricts access to on-line and off-line programming, the backup, delete, initialize and copy utilities, and password definition. You can use the Supervisor password to change the passwords or to gain access to those areas protected by the Operator password. If on-line programming is protected by the Supervisor password, the operator can access Date and Time and Timers by pressing ENTER.

The supervisor password restricts access to On-line or Off-line Programming, Backup and Password. You can use the supervisor password to gain access to those areas protected by the operator password.



At the prompt, select Operator or Supervisor and enter a password of up to 8 characters. For each character you enter, you see an asterisk on the command line. The Programmer prompts for verification. Re-enter the password.

If you want to change a password, you can overwrite it. To remove a password, enter a blank field.

A new password is activated the next time a user enters the Programmer.

In a KVIEW or Mini-KVIEW environment, the supervisor and operator passwords are defined as part of the KVIEW configuration process.

Initialize I/O

Use Initialize I/O to delete the existing program at the Kaye I/O, and set all addresses to the defaults (see Initialize I/O in the *Glossary*).

This option is useful when you are creating a new file in On-line Programming. The file reflects Kaye I/O defaults, and you can make the file and the Kaye I/O program match by initializing the hardware.

Select Initialize I/O. If you are running The Programmer with KVIEW, you are prompted for the I/O unit identification.

The Programmer displays this message:

> "You are about to initialize the Kaye I/O. Initialization will delete the current program and enter a default program."

You are prompted for confirmation. During the initialization process, a counter indicates the percentage complete.

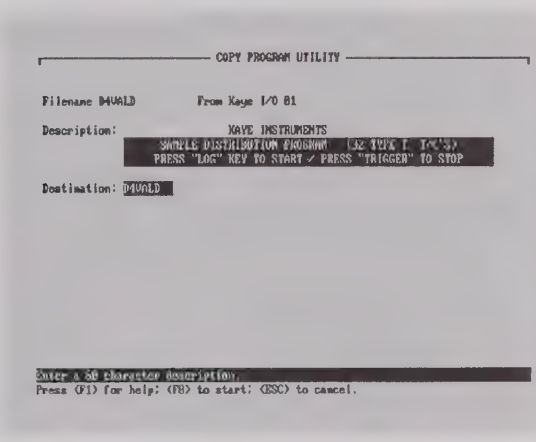
To cancel, press ESC. This leaves the Kaye I/O program incomplete.

While initializing the Kaye I/O with The Programmer sets the hardware to default parameters, it does not clear the RAM. When you need to perform a complete hardware reset (for example, if your system has not been used for several months), use the initialization jumper on the Kaye I/O unit.

Copy

The Copy utility copies a program file to another file of the same or different name.

You also use the Copy utility to change the file description.


COPY PROGRAM UTILITY
Filename B4VALD
From Keys I/O 81
Description:
KAVE INSTRUMENTS
SAMPLE DISTRIBUTION PROGRAM
PRESS "LOG" KEY TO START ✓ PRESS "TRIGGER" TO STOP
Destination: B4VALD
Enter a 50 character description.
Press (F1) for help; (F8) to start; (ESC) to cancel.

After selecting Copy, you are prompted to select a source file name. A window displays a field for the destination file name and the file description. The default for the file name is blank and the default for the descriptor is the same descriptor as in your source file. You can edit the descriptor and enter a new destination file name. If you do not change the destination file name, the name of the source file is entered automatically.

Press F8 to start copying. If the destination file name already exists, you are asked if you want to overwrite the file.

6. Kaye I/O Reference

This section gives you an overview of how Kaye I/O operates. You can get more detailed information from The Programmer's on-line help screens and the documentation supplied with your hardware.

System Architecture

The Kaye I/O system is used for industrial data acquisition, analysis and supervisory control. It accepts analog and digital inputs from your process, performs conversions and calculations, and outputs analog and discrete signals to the process and to an operator interface.

The figure on the next page illustrates the system architecture.

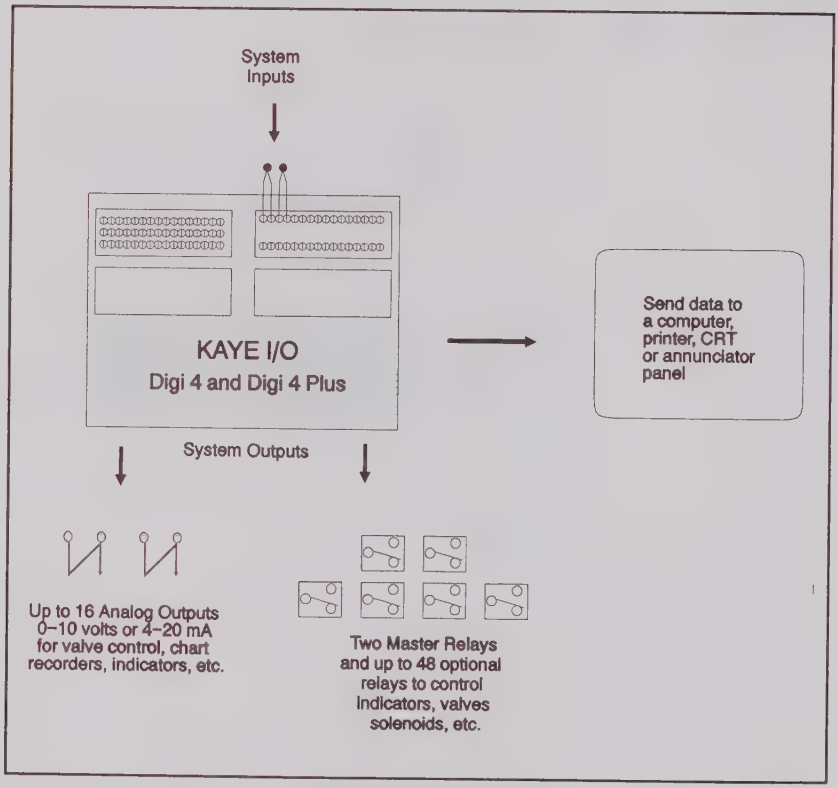


Figure 6-1. Kaye I/O System Architecture

System Inputs

Analog and digital inputs from your process are connected directly to Kaye I/O scanners. Data can come from:

- thermocouples
- RTD's
- pressure transducers
- flow meters
- 4-20 mA transmitters
- strain gauges
- thermistors
- load cells
- switches or pushbuttons
- thumbwheel switches
- pulse or frequency (0-10 KHz range) inputs
- 0-12 VDC transducers

Plug-in scanners accommodate up to 16 inputs each. The number of total system inputs may vary with the hardware. For example, the Digistrip 4 or 4 Plus (without an expansion chassis) supports four scanners, for a maximum of 64 inputs, while the large NEMA 4 version can support up to 128 analog and 32 status inputs.

Analog Scanners accept inputs from various thermocouple types, voltage transducers and current transmitters. RTD Scanners accept inputs from 3-wire 100Ω platinum and 10Ω copper RTD's. A 17-bit analog/digital converter provides measurement accuracy up to 0.1°C.

Status Input Scanners accept 24 to 48 VDC or VAC discrete inputs from external devices. Analog Plus/Status scanners accept 8 analog and 8 dry contact discrete inputs.

In addition to direct input, Kaye I/O accepts data from Frequency Scanners, Digital Input Scanners and Bridge Conditioners.

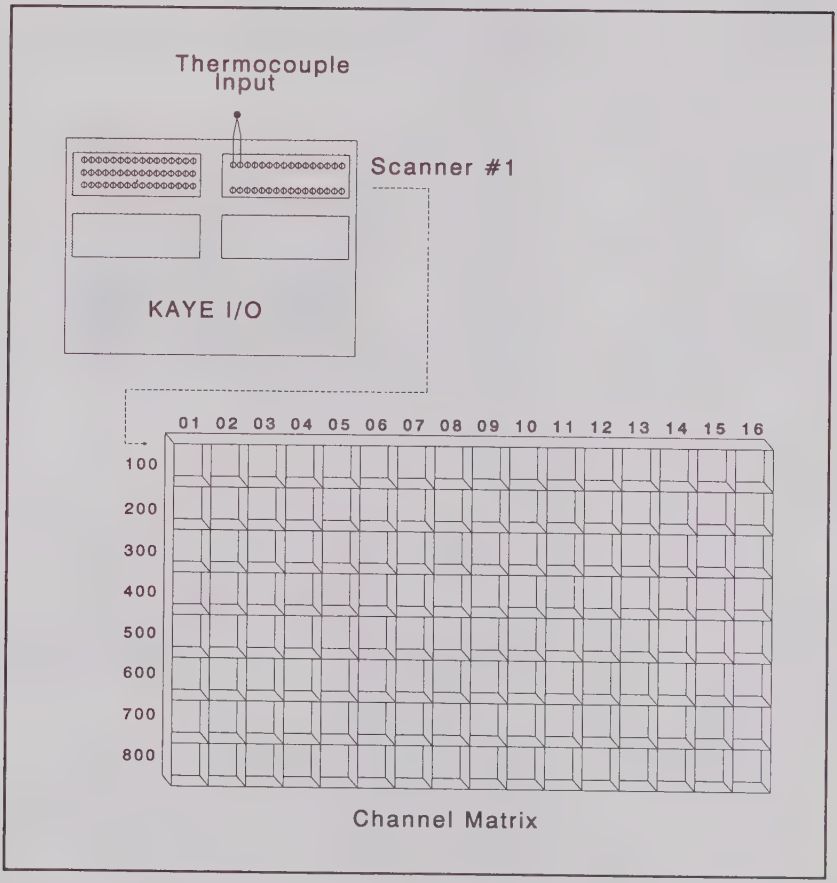


Figure 6-2. Mapping Inputs to Channels

Mapping Input Data to Kaye I/O Channels

Inside the Kaye I/O, analog input data is directed to workspaces called channels. There is a matrix of 128 channels, arranged in 8 rows of 16 columns. Each channel has a unique address, numbered 101-116, 201-216 . . . 801-816. The first digit of the channel address is the row number, and the second and third digits are the column number.

You assign, or map, each Analog and RTD Scanner to a separate row of channel addresses. Each scanner, except the Analog Plus/Status Input scanner, has a jumper switch located behind the connection terminals that defines its bank number. The Analog Plus/Status Input scanner is fixed as Bank #1.

When you buy a Kaye system with several scanners, the jumpers are factory set and each scanner is labelled with a different bank number. If you add scanners, set the jumper on each one for a unique bank number.

To map scanners to the Kaye I/O channel matrix with The Programmer, select Configuration, then Scanner Mapping.

By default, analog inputs connected to scanner #1 are mapped to Channel addresses 101-116.

Status Inputs are not directed to the channel matrix. These signals go to pre-assigned logic addresses in the Kaye I/O's memory (see Logical Sources).

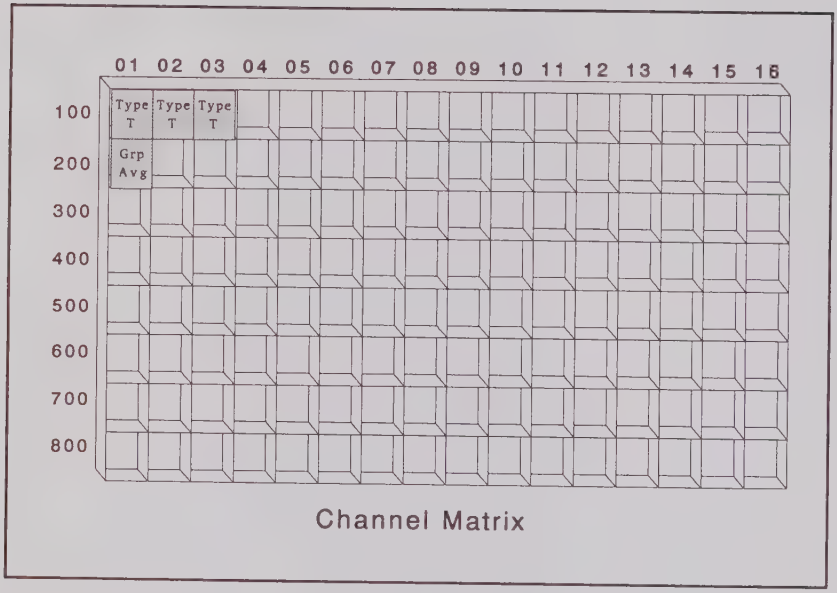


Figure 6-3. Assigning a Function

Assigning a Function

Once you have mapped input data to a channel, you tell the Kaye I/O what to do with the data by assigning a function to that channel. At The Programmer, select Channels from the programming menu.

Kaye I/O hardware has a built-in library of standard functions that range from simple input measurement to complex computing algorithms.

Input Functions

Assign the appropriate input function – direct voltage, linear conversion, thermocouple, RTD or multi-segment input – to channels receiving system inputs.

Figure 6-3 shows the Type T thermocouple function programmed at Channels 101, 102 and 103.

Data Analysis and Reduction Functions

At other channels, assign functions that analyze and manipulate the input data.

For example, at Channel 201 you could assign a group average function that computes the average temperature at Channels 101-103.

Table 6-1. Kaye I/O Function Library

Voltage Input
±60 mV (001)
±600 mV (002)
±6 V (003)
±12 V (004)
±30 mV (005)

Thermocouple Input
B, 0.1°F (018)
B, 0.1°C (019)
C, 0.1°F (020)
C, 0.1°C (021)
E, 0.1°F (022)
E, 0.1°C (023)
J, 0.1°F (024)
J, 0.1°C (025)
J, 0.1°C DIN (026)
K, 0.1°F (027)
K, 0.1°C (028)
N, 0.1°F (029)
N, 0.1°C (030)
R, 0.1°F (031)
R, 0.1°C (032)
S, 0.1°F (033)
S, 0.1°C (034)
T, 0.1°F (035)
T, 0.1°C (036)
T, 0.01°C (037)
T, 0.1°C DIN (038)

RTD Input
100Ω Pt 3-wire, 0.1°F (039)
100Ω Pt 3-wire, 0.1°C (040)
100Ω Pt 3-wire, 0.01°C (041)
100Ω Pt 4-wr 1mA, 0.1°F (042)
100Ω Pt 4-wr 1mA, 0.1°C (043)
100Ω Pt 4-wr 1mA, 0.01°C (044)
10Ω Cu 3-wire, 0.1°F (045)
10Ω Cu 3-wire, 0.1°C (046)

Linear Input and Transfer
±60 mV Unbounded (006)
±60 mV Bounded (010)
±60 mV Clamped (014)
±600 mV Unbounded (007)
±600 mV Bounded (011)
±600 mV Clamped (015)
±6 V Unbounded (008)
±6 V Bounded (012)
±6 V Clamped (016)
±12 V Unbounded (009)
±12 V Bounded (013)
±12 V Clamped (017)
Transfer Unbounded (051)
Transfer Bounded (052)
Transfer Clamped (053)

Multi-segment Input and Transfer
±60 mV Input (047)
±600 mV Input (048)
±6 V Input (049)
±12 V Input (050)
Transfer (054)

Polynomial Transfer (099)

Math
$X_1 + X_2$ (084)
$X_1 - X_2$ (085)
$X_1 * X_2$ (086)
X_1 / X_2 (087)
$X_1 ** X_2$ (088)
SQRT X (089)
Log X (090)
LN X (091)
Exponential X (092)
SIN X (093)
COS X (094)
TAN X (095)
ARC SIN X (096)
ARC COS X (097)
ARC TAN X (098)

Channel Group
Pair
Maximum (082)
Minimum (083)
Group
Average (075)
Maximum (076)
Address of Maximum (100)
Minimum (077)
Address of Minimum (100)
Sum (080)
Standard Deviation (081)
4 Highest (078)
4 Highest with addresses (079)

Time Interval
Average (061)
Maximum (062)
Address of Maximum (100)
Minimum (063)
Address of Minimum (100)
Rate of Change (064)

Totalization
Accumulation
Display Only (055)
Print Total (056)
Transmit Total (057)
Print and Transmit (058)
Meter
8-digit total (059)
Elapsed Timer
Run on True (065)
Run on False (066)
Counter
False to True (060)

Skip, Offset and Optional Data
Skip (000)
Bytes in Text Buffer/Zero Offset (199)
Optional Data Storage (100)

Application-Specific
Relative Humidity (130)
Cylindrical Tank Volume (131)
Spherical Tank Volume (132)
Lethality Rate (133)
Linear Weighting (160)
Gas Specific Volume (161)
Natural Gas Specific Vol - AGA-3 (162)
Natural Gas Specific Vol - AGA-8 (167)
Steam Specific Volume - Input in °F (163)
Steam Specific Volume - Input in °C (165)
Enthalpy of Steam - Input in °F (164)
Enthalpy of Steam - Input in °C (166)
Orifice Flow - Simple Orifice (170)
Orifice Flow - Flange Taps Upstream (171)
Orifice Flow - Flange Taps Dnstream (172)
Orifice Flow - Pipe Taps Upstream (173)
Orifice Flow - Pipe Taps Downstream (174)
Compressor Efficiency (175)
ASME MFC-3M-1985 Orifice Meter (176)
ASME MFC-3M-1985 Flow Nozzle (177)
ASME MFC-3M-1985 Venturi Meter (178)
Saturation Pressure of Steam, °F (180)
Saturation Pressure of Steam, °C (181)
Saturation Temperature of Steam, °F (182)
Saturation Temperature of Steam, °C (183)
Entropy of Steam, °F (184)
Entropy of Steam, °C (185)
Specific Volume of Water, °F (186)
Specific Volume of Water, °C (187)
Enthalpy of Water, °F (188)
Enthalpy of Water, °C (189)
Entropy of Water, °F (190)
Entropy of Water, °C (191)
Turbine Efficiency, °F (192)
Turbine Efficiency, °C (193)
Turbine Exhaust, °F (194)
Turbine Exhaust, °C (195)

Data Transfer and Store a Constant
Transfer on True (Store a Constant) (114)
Transfer on False (115)
Transfer or Manual Input (129)

Data Select
Select on True (Consecutive) (116)
Select on False (Consecutive) (117)
Select on True (Non-consecutive) (118)
Select on False (Non-consecutive) (119)
Select 1 of 4 Local Constants (120)
Select 1 of N Channel Values (128)

Data Compare
True when $X_1 - X_2$ (112)
True when $X_1 > X_2$ (113)

Integer Encoder
Two bit (121)
Four bit (122)

Boolean and Flip/Flops
Boolean
AND: AB (101)
NAND: -(AB) (106)
Mixed AND: A(-B) (102)
OR: A+B (104)
NOR: -(A+B) (103)
MIXED OR: A+(-B) (105)
XOR: (A(-B))+((-A)B) (107)
Flip/Flop
Set on True; Reset on True (108)
Set on True; Reset on False (109)
Set on False; Reset on True (110)
Set on False; Reset on False (111)

Control Timer/Counter
Timer Run on True; Reset on True (124)
Run on False; Reset on True (125)
Run on True; Reset on False (126)
Run on False; Reset on False (127)
Control Counter (123)

PID and Sequencer
Proportional control - External reset (140)
Proportional control - Error Squared ((141)
Standard PID (142)
Standard PID - Error Squared (143)
Batch preload PID (144)
Batch preload PID - Error Squared (145)
Cascade PID (146)
Cascade PID - Error Squared (147)
Track or Hold (148)
Hold or Track (149)
Sequencer (150)

Historical Buffer
Average (067)
Maximum (068)
Minimum (069)
Sum (072)
Standard Deviation (073)
Selects nth Sample (070)
Selects 4 highest (071)
Clears the Buffer (074)

Function Library

Table 6-1 lists the complete Kaye I/O Function Library. The function codes in parentheses are used only when you program the Kaye I/O from the front panel.

The various models of the Digi 4 Plus and standard Digi 4 have different sets of built-in functions. When you program on line, The Programmer determines the hardware type and displays the available functions. When you program off line, you select your hardware type, and The Programmer displays the available functions.

Determining Additional Programming Parameters

The function you assign to a channel determines what additional parameters you program.

For example, Voltage, Thermocouple and RTD input functions do not require additional data. The resolution of the output data and the engineering units are determined by the function. However, you have the option of programming a filter time. Also, with all input functions except Voltage, you can perform automatic sensor calibration (AUTOCAL) at the front panel. You can calibrate thermocouples and RTD's with the Calibration feature of The Programmer.

With data analysis and reduction functions, you *must* program addresses where additional data can be found. The programming screen indicates the additional parameters, both required and optional.

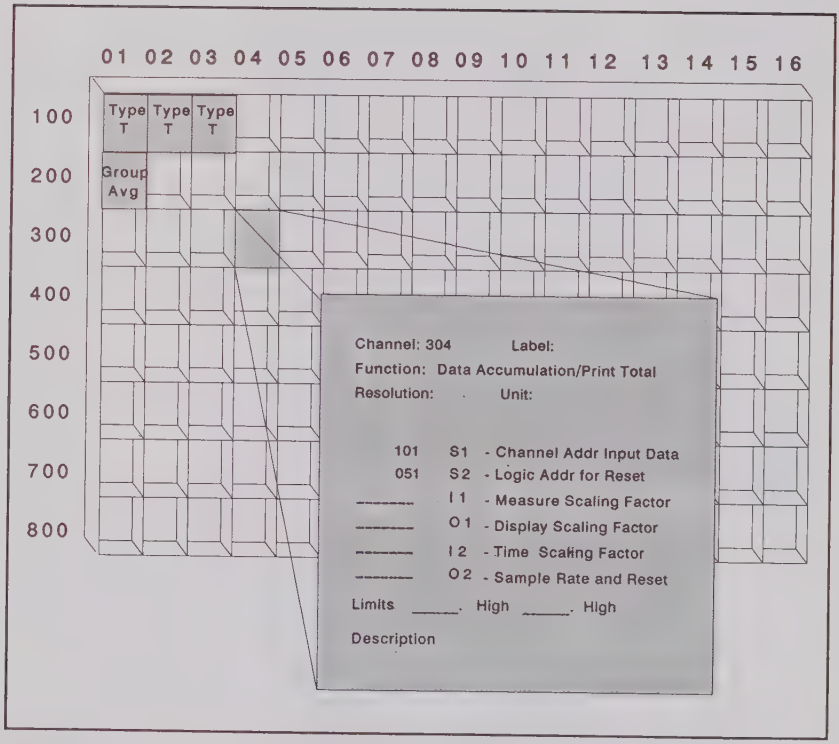


Figure 6-4. Function-specific Channel Parameters

Channel Parameters

When you select a function, The Programmer displays the applicable parameters. For example, Figure 6-4 shows the Data Accumulation/Print Total function programmed at Channel 304. S1 and S2 (Source 1 and Source 2) are required, while I1, I2, O1 and O2 (Inputs 1 and 2 and Outputs 1 and 2) are optional. Channel parameters can include:

Label

Identifies a channel in reports, messages and the Programmer Channel Map. If you do not enter a label, you see question marks (??) on the Channel Map.

Resolution

Specifies decimal location in the output data.

Unit

Identifies the engineering units of the output data.

S1, S2 (Source 1 and Source 2)

Store a 3-digit address of analog (numerical) or digital (logic) data. Kaye I/O sources are listed on the next page. Figure 6-4 shows Channel 101 as the source of the input data and Status Input 051 as the reset logic bit.

I1, I2, O1 and O2 (Inputs 1 and 2, Outputs 1 and 2)

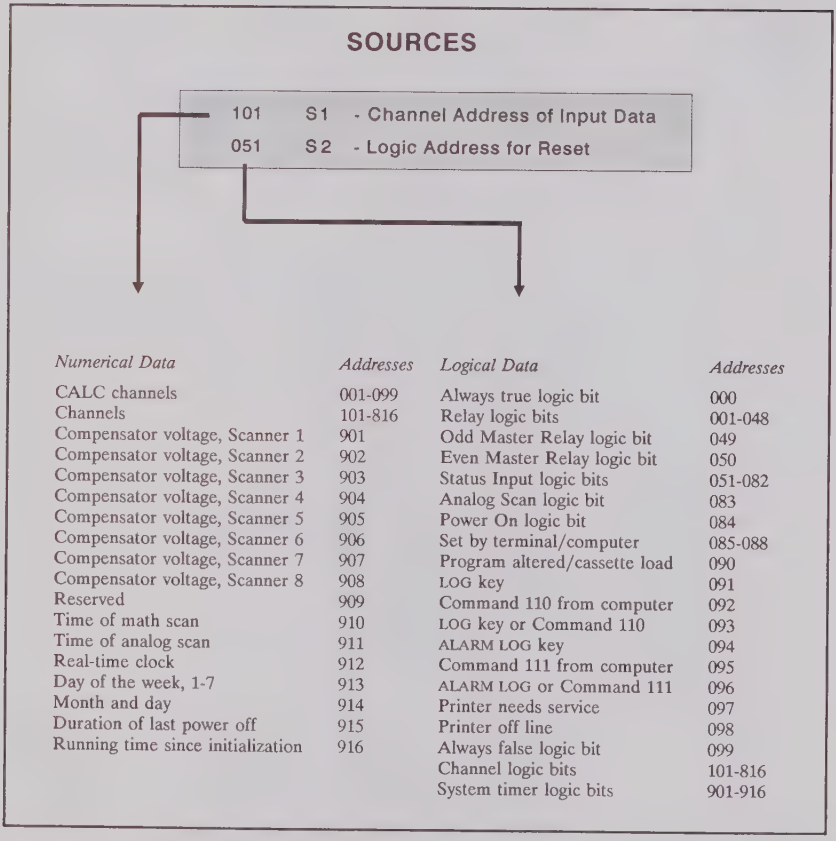
Store constant values used by the function. To clear the field, enter NULL. Depending on the function, NULL disables the operation or resets the defaults.

Limit 1, Limit 2

Specify a bound against which the Kaye I/O compares channel output data. Limit 1 can be high, low or rate of change; Limit 2 can be high or low. To disable limit processing, enter NULL.

Description

Identifies channel in program listing. The description is stored in the program file, not at the Kaye I/O, and serves as documentation for the program.



Numerical Data	*Addresses*	*Logical Data*	*Addresses*
CALC channels	001-099	Always true logic bit	000
Channels	101-816	Relay logic bits	001-048
Compensator voltage, Scanner 1	901	Odd Master Relay logic bit	049
Compensator voltage, Scanner 2	902	Even Master Relay logic bit	050
Compensator voltage, Scanner 3	903	Status Input logic bits	051-082
Compensator voltage, Scanner 4	904	Analog Scan logic bit	083
Compensator voltage, Scanner 5	905	Power On logic bit	084
Compensator voltage, Scanner 6	906	Set by terminal/computer	085-088
Compensator voltage, Scanner 7	907	Program altered/cassette load	090
Compensator voltage, Scanner 8	908	LOG key	091
Reserved	909	Command 110 from computer	092
Time of math scan	910	LOG key or Command 110	093
Time of analog scan	911	ALARM LOG key	094
Real-time clock	912	Command 111 from computer	095
Day of the week, 1-7	913	ALARM LOG or Command 111	096
Month and day	914	Printer needs service	097
Duration of last power off	915	Printer off line	098
Running time since initialization	916	Always false logic bit	099
		Channel logic bits	101-816
		System timer logic bits	901-916

Figure 6-5. Data Sources for Kaye I/O Functions

Sources

Kaye I/O hardware contains two types of data – numerical and logical. Source 1 and Source 2 specify the addresses of the data.

The function determines whether numerical or logical data is used. For example, if an addition function ($X_1 + X_2$) is entered, Source 1 and Source 2 are numerical addresses.

However, if a Boolean AND function is entered, Source 1 and Source 2 are logic addresses.

Some functions use both numerical and logical data. For example, the Data Accumulation/Print Total function shown in Figures 6-4 and 6-5 requires numerical input data at Source 1 and a logic address at Source 2.

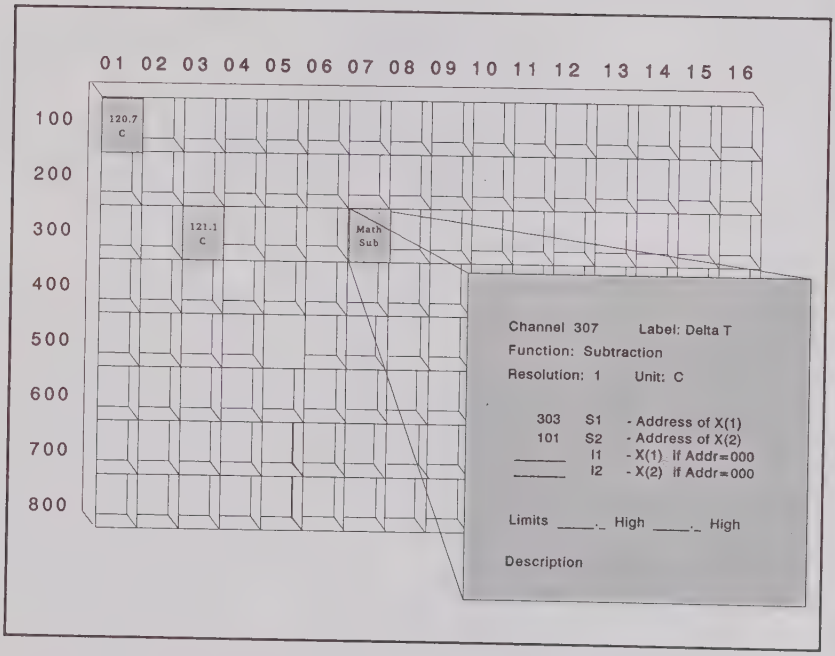


Figure 6-6. Numerical Sources

Numerical Sources

Numerical data, most often from channels, is used as input by functions at other channels.

You program an address into the Source 1 or Source 2 parameter, and the Kaye I/O retrieves the data stored at that address and uses it in the function.

For example, Figure 6-6 shows output values of 120.7°C at Channel 101 and 121.1°C at Channel 303.

These addresses are used as sources for a Subtraction function (Source 1 = 303, Source 2 = 101) that is calculating the difference between two measured temperatures.

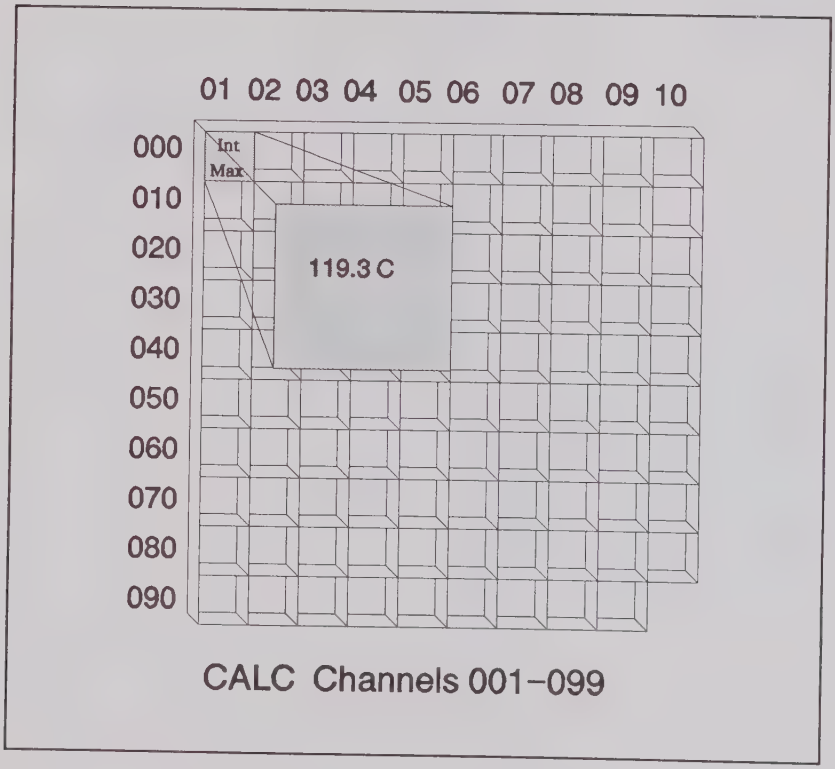


Figure 6-7. CALC Channels

CALC Channels

CALC Channels are workspaces similar to Channels 101-816, except that they do not accept direct inputs, functions that output logical data, or functions that generate a one-line message, such as the accumulation functions. You cannot set limits on CALC Channel data or include it in a report.

To program a CALC channel, select Channels from the programming menu. At the Channel Map, press PG DN for the CALC Channel Map. Scroll the CALC channels with ↑ and ↓.

Program a function at a CALC Channel and use the result as a source for another function. For example, you can program an interval maximum function at a CALC Channel, as shown in Figure 6-7, and then specify the CALC Channel address as the source for a function that is calculating the difference between the current temperature and the maximum temperature.

Standard Digi 4 models do not include CALC channels.

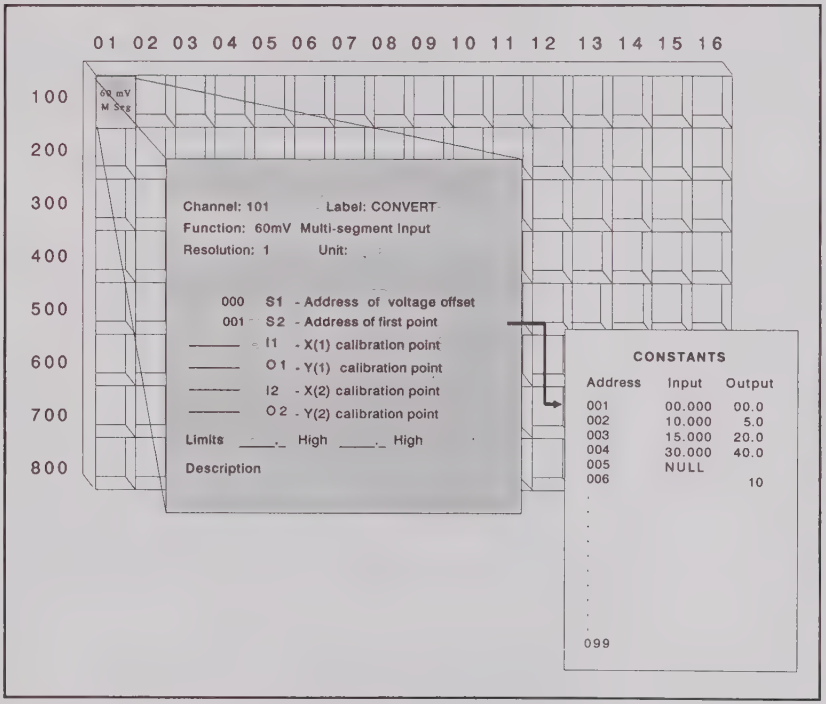


Figure 6-8. Constant Address Used as a Function Source

Constants

Kaye I/O units have 99 Constant addresses, each of which can store a pair of constants, referred to as the Input Constant and the Output Constant.

With the Multi-segment Input and Transfer functions, you use the Input and Output Constants at consecutive Constant addresses to specify segment endpoints.

For example, Figure 6-8 shows endpoint values for the Multi-segment Input function programmed at Constant addresses 001-004. The voltage inputs are stored in the Input Constant parameter, and the corresponding engineering unit outputs are stored in the Output Constant parameter. The word "NULL" programmed into the Input Constant parameter at address 005 indicates the end of the data.

You also use Constant addresses with the Polynomial Transfer function: Polynomial constant = (Output x 10^{Input}).

In the standard Digi 4 series, Constant addresses are used as sources for a number of other functions. For example, you can use a Constant address with Voltage, Thermocouple and RTD input functions to hold the filter time. In Figure 6-8, Constant address 006 holds a filter time of 10 seconds in its Output Constant parameter.

To access a Constant address, select Constants from the programming menu.

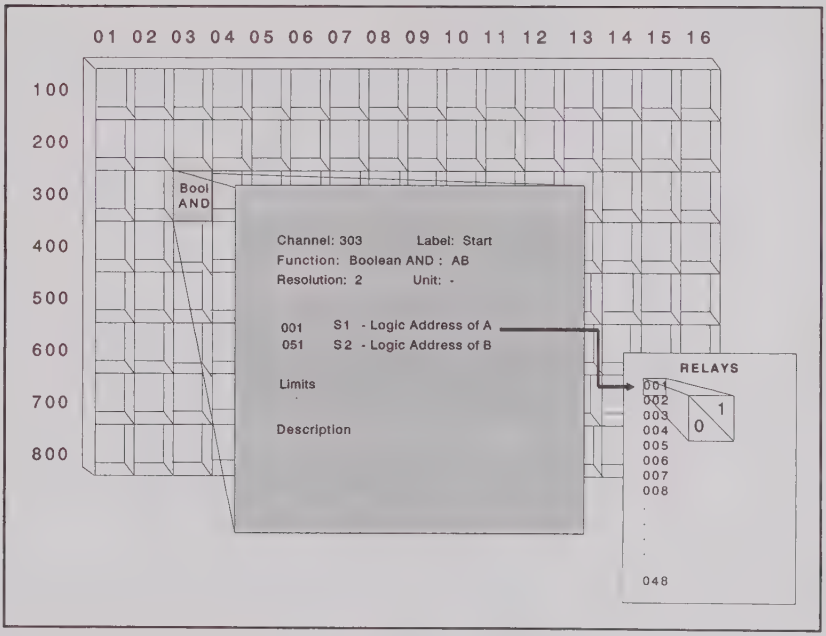


Figure 6-9. Relay Address used as a Function Source

Logical Sources

Logical sources, or addresses, store a logic bit that is either ON or OFF (1 or 0, TRUE or FALSE).

Except for the Always TRUE System Logic Bit, Kaye I/O logic bits are normally FALSE. For a list of logical sources, access a channel screen and press ALT-F1 at a Source 1 or 2 parameter requiring a logic address.

Logical Sources	*Addresses*
Always TRUE logic bit	000
Relay logic bits	001-048
Odd Master Relay logic bit	049
Even Master Relay logic bit	050
Status Input logic bits	051-082
Analog Scan logic bit	083
Power On logic bit	084
Set by terminal/computer	085-088
Operator panel/Printer control	090-098
Always FALSE logic bit	099
Channel logic bits	101-816
System timer logic bits	901-916

In the Kaye I/O, logical sources are required for Time Interval, Totalization, Conditional Transfer, Data Select, Integer Encoder, Boolean and Flip/Flop, Control Timer, Control Counter, PID and Sequencer functions, and to trigger reports.

Relays

Figure 6-9 shows relay logic bit 001 used as Source 1 for the Boolean AND function. Source 2 is a status input (see next page).

Relay logic bits can also drive optional solid state relay outputs. The relays can be latched so that they retain the state of their logic bits during a power outage.

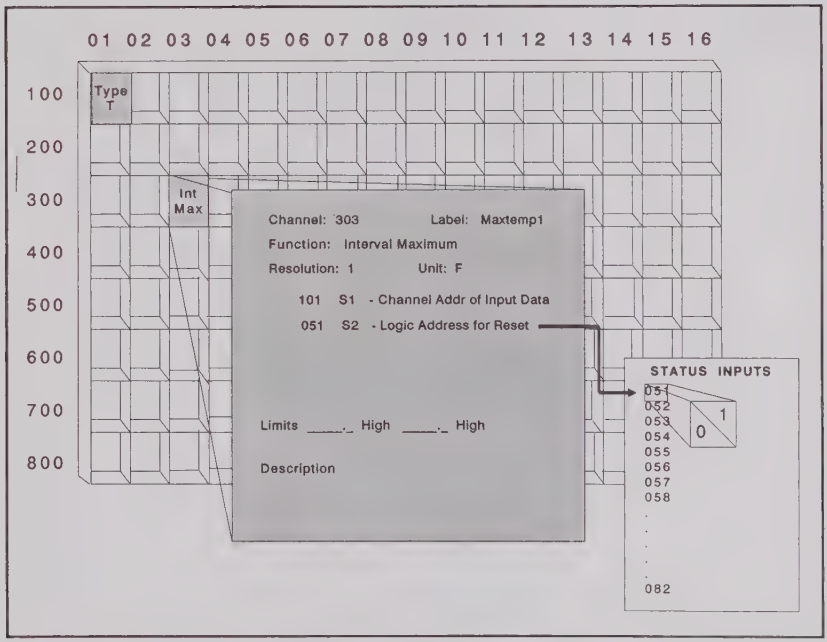


Figure 6-10. Status Input Address used as a Function Source

Status Inputs

Status Input logic bits are controlled by external switches or pushbuttons, and are set TRUE when a contact is closed. Kaye I/O hardware monitors up to 32 status inputs.

Figure 6-10 shows Status Input address 051 used as a source for the Time Interval Maximum function. The interval is reset when an operator pushes a switch.

Status Input logic bits are also used as transition tests for the Sequencer function (see *Sequencer Function* manual, Document M4131).

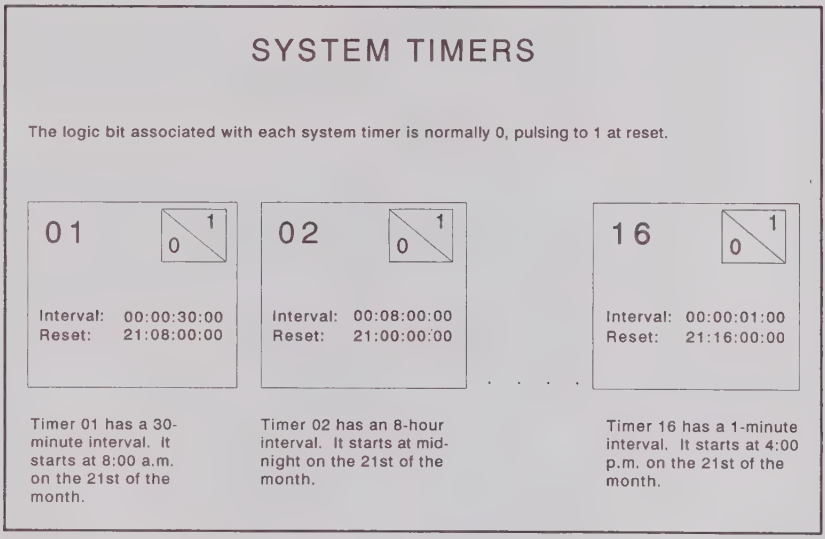

SYSTEM TIMERS
The logic bit associated with each system timer is normally 0, pulsing to 1 at reset.
01
1
0
Interval: 00:00:30:00
Reset: 21:08:00:00
02
1
0
Interval: 00:08:00:00
Reset: 21:00:00:00
16
1
0
Interval: 00:00:01:00
Reset: 21:16:00:00
Timer 01 has a 30-minute interval. It starts at 8:00 a.m. on the 21st of the month.
Timer 02 has an 8-hour interval. It starts at midnight on the 21st of the month.
Timer 16 has a 1-minute interval. It starts at 4:00 p.m. on the 21st of the month.

Figure 6-11. Programming System Timers

System Timers

Kaye I/O hardware has 16 system timers, each controlling a logic bit that is set momentarily true when the timer resets.

Programming a timer. System timers require an interval and a reset time. The reset time specifies the initial start, and the Kaye I/O automatically updates the reset according to the interval.

System timers are synchronized to the Kaye I/O system clock. The Kaye I/O compares the reset time of each timer to the clock. When the two are equal, the timer's logic bit turns momentarily true and the Kaye I/O automatically calculates a new reset time.

When you restore a program file to a Kaye I/O unit, the reset times may no longer be current. When the restore is complete, go into On-line Programming, select System Timers and update the reset times.

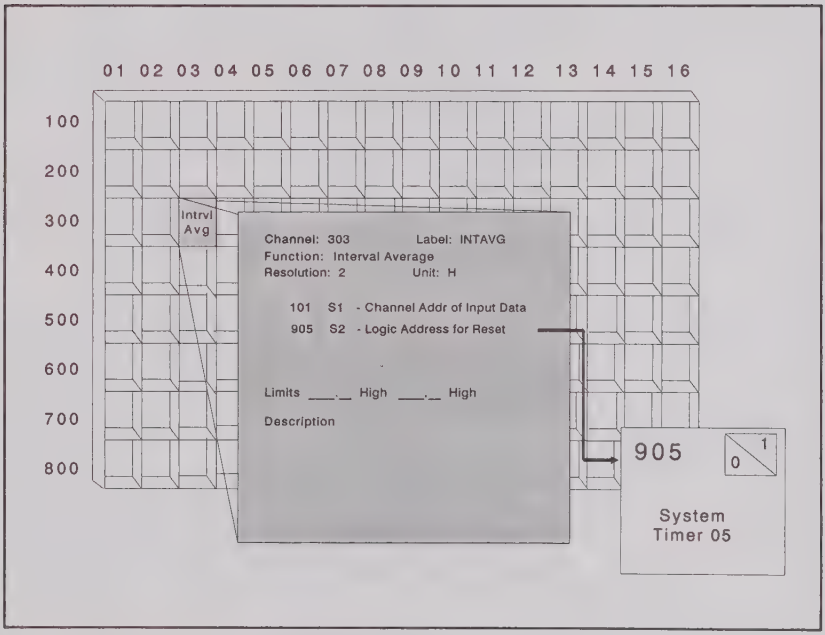


Figure 6-12. System Timer used as a Function Source

System Timers as sources. The system timer logic bits are stored at logic addresses 901-916. These logic bits can be used to control data sampling, reset accumulation totals or trigger reports.

Figure 6-12 shows System Timer 05 used to reset the Interval Average function. When Timer 05 resets, the logic bit at logic address 905 is pulsed to 1, and the interval average is reset.

The Digi 4 Plus automatically updates all system timers when the system clock is changed, whether it is set ahead or set back, *if the reset time is within one interval of the clock time* (see page 3-23). For example, suppose the system clock reads 3:00 and Timer 01 is set to trip at 3:05. If you change the system clock to 4:00, Timer 01 is updated to trip at 4:05.

If you have a standard Digi 4, you must manually update reset times after you change the system clock. The Programmer's On-line mode CTRL-V feature will help you make the necessary changes.

NOTE to KVIEW Users

KVIEW and Mini-KVIEW give you the option of synchronizing all the clocks in the network by broadcasting the computer's date and time at 10-minute intervals to all configured Digi 4 Plus units. (All Digi 4 Plus units must be at software level 2.10 or higher, or the broadcast is disabled.)

When the I/O clocks are updated, Digi 4 Plus system timers are automatically updated.

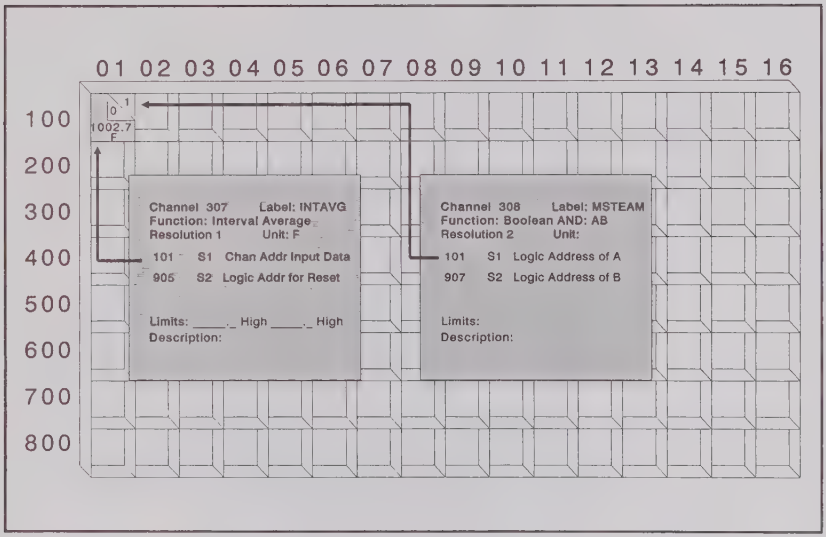


Figure 6-13. Channel Address as both Logical and Numerical Source

Channel Addresses

Channel Addresses 101-816 can be used as both numerical and logical sources. Each channel has a logic bit as well as a numeric value.

Figure 6-13 shows channel address 101 programmed to convert input from a Type N thermocouple to degrees F. A function that uses numerical data can access the data at this channel. For example, an interval average function can use the data to calculate the average temperature during a specified time interval.

If you program a high limit on the thermocouple measurement, the logic bit at channel address 101 can be turned on when the limit is exceeded. A function that uses logical data can access the state of this logic bit. For example, you can use channel address 101 as one input for the Boolean AND function.

You could also use the logic bit at channel 101 to reset a timer or trigger a report.

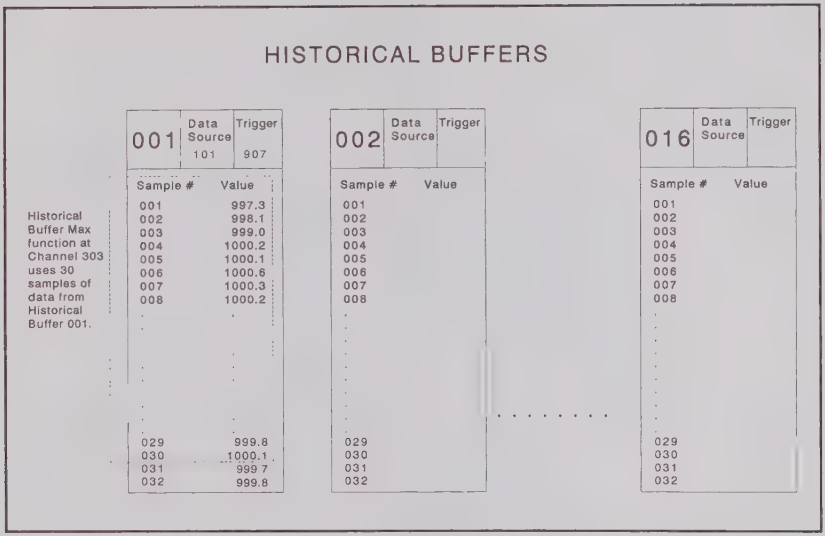


Figure 6-14. Programming Historical Buffers

Historical Buffers

Historical Buffers are first-in, first-out (FIFO) temporary storage buffers used as sources with the Historical Buffer functions. There are 16 historical buffers, each storing up to 32 data samples.

You could program an historical buffer, for example, to take samples of a temperature reading at 2-minute intervals. Then you could use the buffer as the source of an Historical Buffer Maximum function, to calculate the highest temperature reading over an hour (30 samples x 2 minutes = 60 minutes of data).

Using an historical buffer involves two steps: 1) programming the buffer itself, and 2) programming the function.

Programming a buffer. Select Historical Buffers from the programming menu. As shown in Figure 6-14, you assign two sources to a buffer address: a Data Source, which is a channel or CALC channel address, and a Trigger, which is a logic address.

The logic bit at the Trigger address governs the time interval between each sample entry. When the logic bit makes a false/true transition, a new sample from the Data Source enters the buffer. When there are 32 samples in the buffer, the next sample to enter forces out the first sample.

In the example, Channel 101 is the Data Source, and logic address 907 is the Trigger. Channel 101 is a thermocouple reading, and Logic Address 907 is System Timer 07, with a reset of 2 minutes.

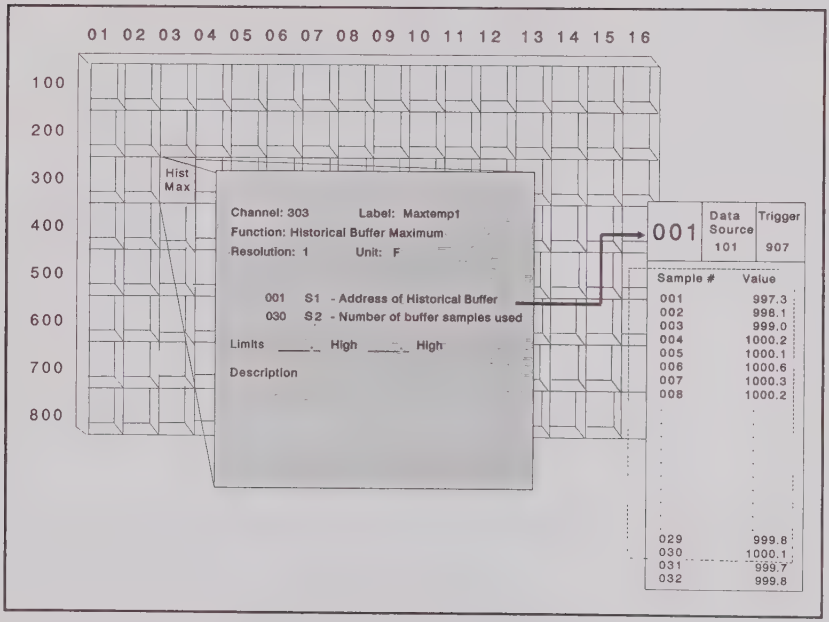
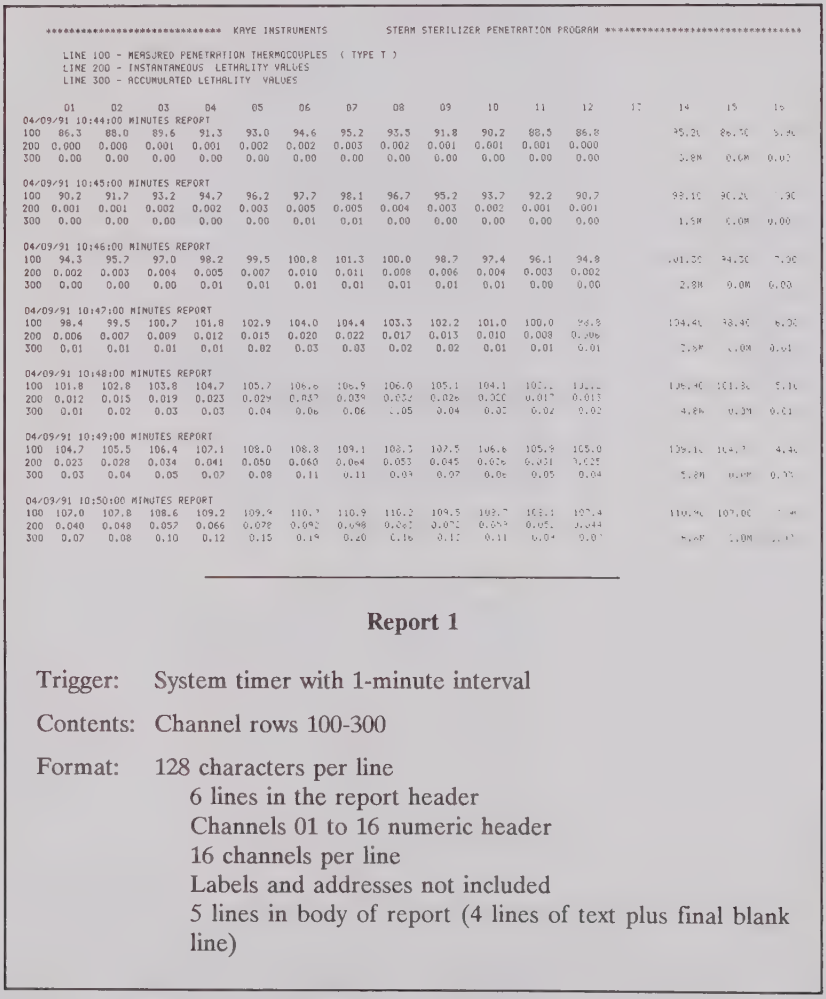


Figure 6-15. Programming an Historical Buffer Function

Programming a Buffer Function. Figure 6-15 shows the Historical Buffer Maximum function programmed into Channel 303.

Continuing with the example from the previous page, Source 1 is Historical Buffer 001. Source 2 is 030, which specifies the number of samples to be used in the calculation. The Buffer Maximum function will select the highest temperature reading at Channel 101 over the period of one hour.

You can include the contents of an historical buffer in a report, to provide a chronological record of output data from one channel address.



```
********** KAYE INSTRUMENTS          STERM STERILIZER PENETRATION PROGRAM **********

     LINE 100 - MEASURED PENETRATION THERMOCOUPLES  ( TYPE T )
     LINE 200 - INSTANTANEOUS  LETHALITY VALUES
     LINE 300 - ACCUMULATED LETHALITY  VALUES

       01     02     03     04     05     06     07     08     09     10     11     12     13     14     15     16
04/09/91 10:44:00 MINUTES REPORT
100   86.3   88.0   89.6   91.3   93.0   94.6   95.2   93.5   91.8   90.2   88.5   86.8          95.2M  86.7M  5.4M
200 0.000  0.000  0.001  0.001  0.002  0.002  0.003  0.002  0.001  0.001  0.001  0.000
300  0.00   0.00   0.00   0.00   0.00   0.00   0.00   0.00   0.00   0.00   0.00   0.00          5.8M   0.0M   0.0

04/09/91 10:45:00 MINUTES REPORT
100   90.2   91.7   93.2   94.7   96.2   97.7   98.1   96.7   95.2   93.7   92.2   90.7          98.1M  90.2M  .3M
200 0.001  0.001  0.002  0.002  0.003  0.005  0.005  0.004  0.003  0.002  0.001  0.001
300  0.00   0.00   0.00   0.00   0.00   0.01   0.01   0.00   0.00   0.00   0.00   0.00          1.5M   0.0M   0.00

04/09/91 10:46:00 MINUTES REPORT
100   94.3   95.7   97.0   98.2   99.5  100.8  101.3  100.0   98.7   97.4   96.1   94.8          101.3M 94.3M  7.9M
200 0.002  0.003  0.004  0.005  0.007  0.010  0.011  0.008  0.006  0.004  0.003  0.002
300  0.00   0.00   0.00   0.01   0.01   0.01   0.01   0.01   0.01   0.00   0.00                 2.8M   0.0M   0.00

04/09/91 10:47:00 MINUTES REPORT
100   98.4   99.5  100.7  101.8  102.9  104.0  104.4  103.3  102.2  101.0  100.0   98.8          104.4M 98.4M  8.3M
200 0.006  0.007  0.009  0.012  0.015  0.020  0.022  0.017  0.013  0.010  0.008  0.006
300  0.01   0.01   0.01   0.01   0.02   0.03   0.03   0.02   0.02   0.01   0.01   0.01          2.5M   0.0M   0.01

04/09/91 10:48:00 MINUTES REPORT
100  101.8  102.8  103.8  104.7  105.7  106.6  106.9  106.0  105.1  104.1  103.1  102.1         106.9M 101.8M  9.1M
200 0.012  0.015  0.019  0.023  0.029  0.037  0.039  0.032  0.026  0.020  0.017  0.013
300  0.01   0.02   0.03   0.03   0.04   0.06   0.06   0.05   0.04   0.03   0.02   0.02          4.8M   0.0M   0.01

04/09/91 10:49:00 MINUTES REPORT
100  104.7  105.5  106.4  107.1  108.0  108.8  109.1  108.3  107.5  106.6  105.9  105.0         109.1M 104.7M  4.4M
200 0.023  0.028  0.034  0.041  0.050  0.060  0.064  0.053  0.045  0.036  0.031  0.025
300  0.03   0.04   0.05   0.07   0.08   0.11   0.11   0.09   0.07   0.06   0.05   0.04          5.8M   0.0M   0.01

04/09/91 10:50:00 MINUTES REPORT
100  107.0  107.8  108.6  109.2  109.9  110.7  110.9  110.2  109.5  108.7  108.1  107.4         110.9M 107.0M  3.9M
200 0.040  0.048  0.057  0.066  0.078  0.092  0.098  0.084  0.071  0.059  0.051  0.044
300  0.07   0.08   0.10   0.12   0.15   0.19   0.20   0.16   0.13   0.11   0.09   0.07          6.8M   0.0M   0.01
```

Report 1

Trigger: System timer with 1-minute interval

Contents: Channel rows 100-300

Format: 128 characters per line
6 lines in the report header
Channels 01 to 16 numeric header
16 channels per line
Labels and addresses not included
5 lines in body of report (4 lines of text plus final blank line)

Figure 6-16. Sample Kaye I/O Report with User's Configuration Instructions

Reports

Kaye I/O hardware can automatically generate reports when any logic bit turns on – for example, when a timer resets or a channel alarm trips. You can define up to 4 separate data reports plus an alarm status report. (If you are using KVIEW, Reports 1 and 2 are reserved for KVIEW, and are automatically configured by the workstation software.)

You specify the report trigger, contents, format, destination and buffer storage options. To set up a report, select Configuration from the programming menu, then Report Configuration.

Trigger

Reports are triggered when a logic bit makes a FALSE to TRUE transition. You select a trigger from the list of Kaye I/O logic addresses, such as a system timer or a channel logic bit tied to a limit. If your Kaye I/O hardware has an operator panel, you can also trigger a report with the LOG key.

Contents

You can include output values from up to 128 channels (not CALC channels), relays and status inputs TRUE/FALSE states, and historical buffer contents.

Format

You can specify:

- Characters per line (page width)
- Number of lines in the header, and whether channels are numbered 01 to 16
- Number of channels in a line
- Inclusion of labels and channel addresses
- Number of lines in the report
- Message addresses of header text
- Condensed report format

Destination/Buffering

Specify whether reports are output immediately to a printer, CRT or computer, or stored temporarily in the text output buffer and released later.

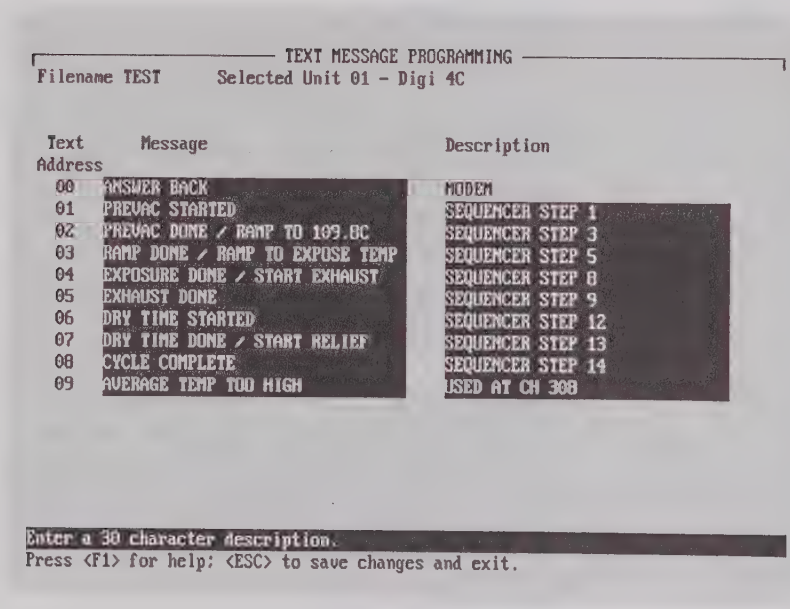


Figure 6-17. Programming Text Messages

Messages

Kaye I/O units have 100 addresses for messages. These addresses can contain report and trend report headers, descriptions of limit action and sequencer operation, auto-dial telephone numbers, and hexadecimal start-of-text (STX) and end-of-text (ETX) messages. The messages are referenced by number at other programming areas.

Report headers

At Report Configuration, specify the address of the first header message. Then access Messages and enter header information in consecutive addresses.

Limit messages

At a Channel screen, set limits and enter addresses for trip and return messages. Then access Messages and enter the text.

Sequencer messages

At the Sequencer screen, enter an address for the output message. Then access Messages and enter the text. Sequencer messages like the ones shown in Figure 6-17 can be used to track process steps and direct the operator.

Auto-Dial Numbers/STX and ETX Messages

Select Configuration, then Report Definition, Limit/Sequencer Messages or Accumulation Totals and specify an address to contain a telephone number for automatic transmission of the report, message or total, and the address of the STX and ETX messages. Then access Messages and enter the text. See Appendix C, Hex - ASCII/equivalents, for the STX and ETX hex codes. STX and ETX messages are automatically printed as part of the first and final lines of reports, messages and totals.

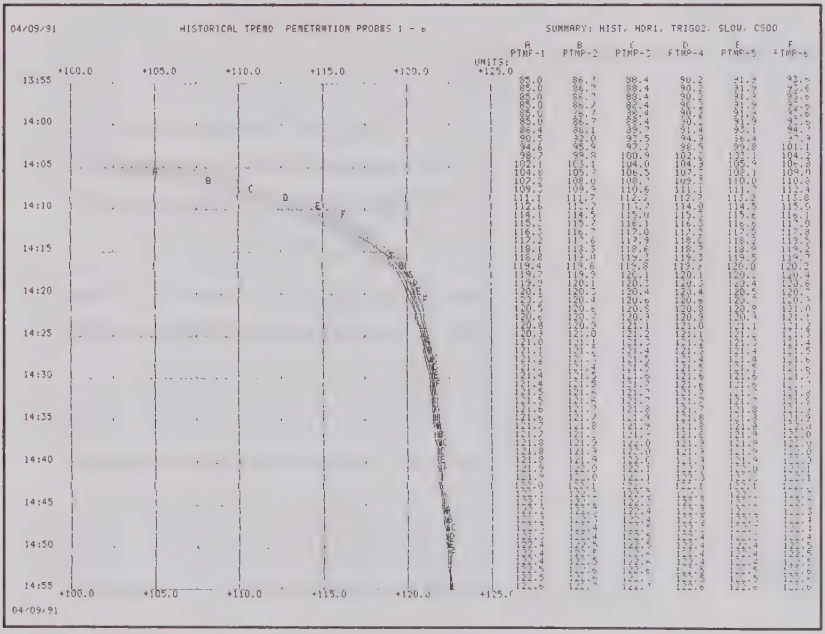


Figure 6-18. 6-Point Historical Trend of a Sterilization Cycle

Auto-Trend

With the Auto-Trend feature built into Kaye's Digistrip 4 and 4 Plus models, you can set up trend reports of live or historical data from up to 32 different channels.

You can graph analog inputs such as temperatures, pressures and flows, analog outputs, and calculated values such as totals and efficiencies. The system can generate nine separate trend charts from the 32 channels you select. Because you select the format, contents and triggers of each trend, you can set up different ways of looking at the same data.

To set up a trend, select Auto-Trend from the programming menu.

Format

There are three pre-defined trend formats: 6-point, 12-point or digital.

Six-point Format. Creates a half-page trend with data from up to six channels and includes six columns of digital data showing the value of each point plotted. An identifier (A-F) appears to the right of each plot line and at the top of each column. (See Figure 6-18.)

Twelve-point format. Creates a full-page trend with data from up to 12 channels and includes a single column of digital data showing the value of each point plotted on a rotating basis. An identifier (A-L) appears to the right of each plot line and to the left of the digital data. (See Figure 6-19.)

Digital format. Creates 12 columns of digital data. A letter (A-L) appears at the top of each column. (See Figure 6-20.)

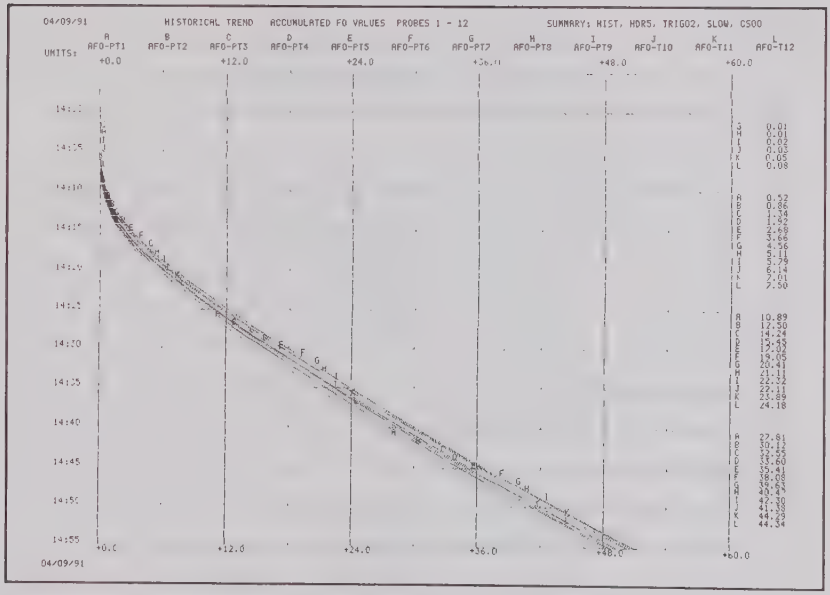


Figure 6-19. Twelve-Point Historical Trend of a Sterilization Cycle

The date of the first point plotted, a top-of-page title and a trend summary appear at the top of each page of a trend report. The summary specifies live or historical mode, identifies the trend (1-9) and its trigger, indicates whether the data is from the fast or slow print buffer and specifies the chart speed. You can also define a bottom-of-page title for each trend and an eight-character label and units identifier for each data point.

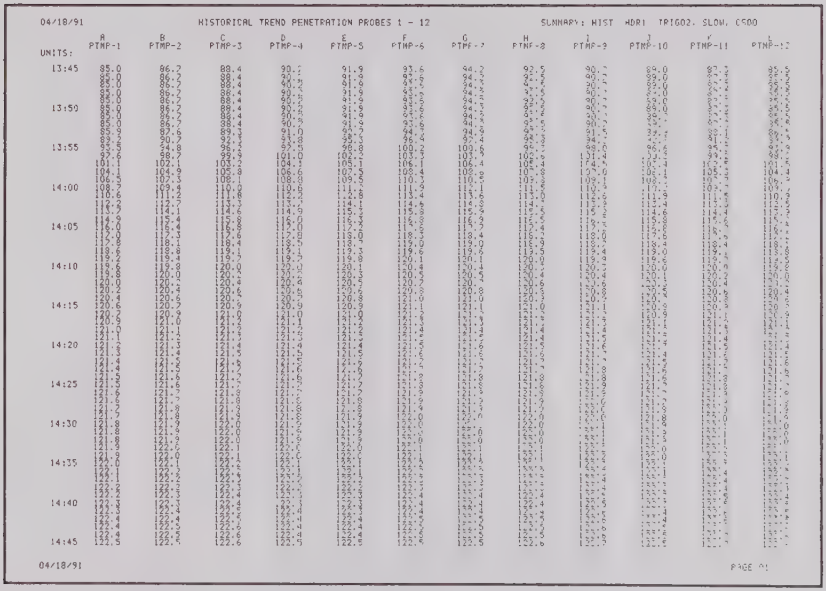
If you select the 6-point or 12-point format, the following also applies:

- Triple-wide lines indicate an alarm condition.
- A point outside the range defined by the left and right margins is not plotted. However, the value of the point is included with the digital data.

Data Report

One of the Kaye I/O's four data reports supplies the data, format and triggers for the trend reports. You specify which data report to use when you select Auto-Trend. You can select any report number, but Kaye recommends that you use data report 4, the default.

When you complete the configuration, the Programmer automatically configures the report, all formatting messages and the system timer. The Kaye I/O prints the contents of the data report the first time the printer receives it or if you change a parameter.



```
04/18/91                    HISTORICAL TREND PENETRATION PROBES 1 - 12                    SUMMARY: HIST  HDR1  TRIGD2. SLOW. C500

                    A          B          C          D          E          F          G          H          I          J          K          L
                PTMP-1     PTMP-2     PTMP-3     PTMP-4     PTMP-5     PTMP-6     PTMP-7     PTMP-8     PTMP-9     PTMP-10    PTMP-11    PTMP-12
UNITS:
  13:45          85.0       86.2       88.4       90.2       91.9       93.6       94.2       92.5       90.2       89.0       87.2       85.5
                 85.0       86.2       88.4       90.2       91.9       93.6       94.2       92.5       90.2       89.0       87.2       85.5
                 85.0       86.2       88.4       90.2       91.9       93.6       94.2       92.5       90.2       89.0       87.2       85.5
                 85.0       86.2       88.4       90.2       91.9       93.6       94.2       92.5       90.2       89.0       87.2       85.5
  13:50          86.0       86.2       88.4       90.5       91.9       93.6       94.2       92.5       90.2       89.0       87.2       85.5
                 86.0       86.2       88.4       90.5       91.9       93.6       94.2       92.5       90.2       89.0       87.2       85.5
                 86.0       86.2       88.4       90.5       91.9       93.6       94.2       92.5       90.2       89.0       87.2       85.5
                 86.0       86.2       88.4       90.5       91.9       93.6       94.2       92.5       90.2       89.0       87.2       85.5
  13:55          89.9       89.3       91.0       92.7       94.4       96.2       96.8       95.1       93.4       91.5       89.7       88.0
                 89.9       89.3       91.0       92.7       94.4       96.2       96.8       95.1       93.4       91.5       89.7       88.0
                 89.9       89.3       91.0       92.7       94.4       96.2       96.8       95.1       93.4       91.5       89.7       88.0
                 89.9       89.3       91.0       92.7       94.4       96.2       96.8       95.1       93.4       91.5       89.7       88.0
  14:00          97.6       98.7       99.9      101.0      102.2      103.9      103.9      102.7      101.4      100.1       98.8       97.5
                 97.6       98.7       99.9      101.0      102.2      103.9      103.9      102.7      101.4      100.1       98.8       97.5
                 97.6       98.7       99.9      101.0      102.2      103.9      103.9      102.7      101.4      100.1       98.8       97.5
                 97.6       98.7       99.9      101.0      102.2      103.9      103.9      102.7      101.4      100.1       98.8       97.5
  14:05         101.1      102.1      103.2      104.1      105.1      106.1      106.4      105.4      104.5      103.5      102.5      101.5
                 104.1      104.9      105.8      106.6      107.5      108.4      108.8      107.9      107.0      106.1      105.2      104.3
                 106.3      107.3      108.1      108.8      109.5      110.3      110.7      109.8      109.1      108.1      107.2      106.3
                 108.2      109.8      110.9      110.6      111.5      111.9      112.1      111.2      110.3      109.3      108.4      107.4
                 110.6      111.2      111.8      112.2      112.8      113.4      113.6      113.0      112.6      111.9      111.3      110.9
                 112.2      112.7      113.3      113.9      114.1      114.6      114.8      114.2      113.8      113.4      112.9      112.4
                 113.9      114.1      114.6      114.9      115.1      115.3      115.2      114.6      114.2      113.9      113.7      113.5
                 114.9      115.4      115.8      116.0      115.8      115.8      115.9      115.4      115.1      114.6      114.4      114.1
  14:10          116.0      116.4      116.8      117.0      117.2      118.0      118.4      117.9      117.5      117.1      116.8      116.4
                 117.0      117.5      117.9      118.2      118.5      118.9      119.0      118.5      118.0      117.6      117.3      116.9
                 117.8      118.1      118.4      118.5      118.7      119.0      119.0      118.5      118.2      117.9      118.4      118.3
                 118.6      119.0      119.1      119.1      119.3      119.6      119.6      119.5      119.4      119.0      119.4      119.3
                 119.2      119.4      119.7      119.7      119.8      120.1      120.1      120.0      119.9      119.6      119.5      119.4
                 119.6      119.8      120.0      120.0      120.1      120.4      120.4      120.2      120.2      120.0      120.0      120.0
                 119.8      120.0      120.2      120.2      120.3      120.5      120.5      120.4      120.4      120.2      120.2      120.2
                 120.0      120.2      120.4      120.6      120.7      120.7      120.7      120.6      120.6      120.5      120.4      120.4
                 120.2      120.4      120.6      120.5      120.8      121.0      121.0      120.9      120.9      120.8      120.8      120.8
                 120.4      120.6      120.7      120.7      120.8      121.0      121.0      120.9      120.7      120.6      120.5      120.5
  14:15          120.6      120.9      120.9      120.9      120.9      121.1      121.1      121.0      121.1      120.9      120.9      120.9
                 120.7      121.0      121.0      121.0      121.0      121.2      121.2      121.1      121.2      121.0      121.1      121.1
                 120.9      121.2      121.1      121.1      121.2      121.3      121.3      121.2      121.3      121.1      121.1      121.1
                 121.0      121.1      121.2      121.2      121.2      121.4      121.4      121.4      121.4      121.2      121.2      121.2
                 121.1      121.1      121.3      121.3      121.3      121.5      121.5      121.4      121.5      121.3      121.4      121.4
  14:20          121.3      121.3      121.4      121.4      121.4      121.6      121.6      121.5      121.6      121.4      121.5      121.4
                 121.3      121.4      121.5      121.5      121.5      121.6      121.6      121.5      121.6      121.4      121.5      121.5
                 121.4      121.4      121.5      121.5      121.6      121.7      121.7      121.6      121.7      121.5      121.6      121.6
                 121.4      121.5      121.6      121.6      121.6      121.7      121.7      121.7      121.8      121.6      121.7      121.6
  14:25          121.5      121.6      121.7      121.6      121.7      121.8      121.8      121.8      121.8      121.6      121.8      121.8
                 121.5      121.6      121.7      121.7      121.7      121.8      121.8      121.8      121.8      121.7      121.8      121.8
                 121.6      121.7      121.8      121.7      121.7      121.9      121.9      121.9      121.9      121.7      121.9      121.9
                 121.6      121.7      121.8      121.8      121.8      121.9      121.9      121.9      121.9      121.8      121.9      121.9
  14:30          121.7      121.8      121.9      121.8      121.8      121.9      121.9      121.9      122.0      121.8      122.0      121.9
                 121.8      121.9      122.0      121.9      121.9      122.0      122.0      122.0      122.0      121.8      122.0      122.0
                 121.8      121.9      122.0      121.9      121.9      122.0      122.0      122.0      122.1      121.9      122.1      122.0
                 121.9      122.0      122.1      122.0      122.0      122.1      122.1      122.1      122.1      122.0      122.1      122.1
  14:35          122.0      122.1      122.2      122.1      122.1      122.2      122.2      122.1      122.2      122.0      122.2      122.1
                 122.1      122.2      122.3      122.2      122.2      122.3      122.3      122.2      122.3      122.1      122.3      122.2
                 122.2      122.3      122.4      122.3      122.3      122.4      122.4      122.3      122.4      122.2      122.4      122.3
                 122.3      122.4      122.4      122.4      122.4      122.5      122.5      122.4      122.5      122.3      122.5      122.4
  14:40          122.4      122.5      122.5      122.5      122.5      122.6      122.6      122.5      122.6      122.4      122.6      122.5
                 122.4      122.5      122.6      122.5      122.5      122.6      122.6      122.5      122.6      122.4      122.6      122.5
                 122.4      122.5      122.6      122.5      122.5      122.6      122.6      122.5      122.6      122.4      122.6      122.5
                 122.4      122.5      122.6      122.5      122.5      122.6      122.6      122.5      122.6      122.4      122.6      122.5
  14:45          122.5      122.5      122.6      122.5      122.5      122.6      122.6      122.5      122.6      122.5      122.6      122.5

04/18/91                                                                                                                          PAGE 01
```

Figure 6-20. Digital Format with 12-Columns of Data

Trending Modes

There are two trending two modes: live and historical.

Live Trending. In the live trending mode, the printer trends data as it is received as long as the Live Trigger is ON. Only one trend report at a time can be in the live trending mode.

You can configure the trend report to include historical data before the live trend begins. The character " > " marks the point where live trending begins. For example, if an alarm condition triggers the trend, you can configure the trend report to precede the live trend with five minutes of historical data to track the conditions that led to the alarm.

If a live trend continues for more than one page, the second page repeats the data printed in the last time stamp interval on the previous page. This establishes continuity from page to page and makes it easier for you to follow the plot lines. Continuous trend pages are also numbered to simplify collation.

Historical Trending. Historical trends are one-page trends. They are not triggered if any live triggers are active.

Historical trends are edge triggered; the trigger generating an historical trend must go from OFF to ON. The chart speed you select determines the amount of data (10 minutes to 24 hours) that appears on the page. Table 6-2 lists the chart speeds.

The chart speed determines how much data (in units of time) appears on each page, the time between data samples and how often samples are copied from the fast to the slow buffer.

Table 6-2. Chart Speeds

	Fast Buffer		*Slow Buffer*	
Chart Speed	*Time between samples*	*Time/Page*	*Time between samples*	*Time/Page*
00	10 seconds	10 minutes	1 minute	1 hour
01	10 seconds	10 minutes	2 minutes	2 hours
02	10 seconds	10 minutes	4 minutes	4 hours
03	10 seconds	10 minutes	6 minutes	6 hours
04	10 seconds	10 minutes	8 minutes	8 hours
05	10 seconds	10 minutes	12 minutes	12 hours
06	10 seconds	10 minutes	16 minutes	16 hours
07	10 seconds	10 minutes	24 minutes	24 hours
08	20 seconds	20 minutes	2 minutes	2 hours
09	20 seconds	20 minutes	4 minutes	4 hours
10	20 seconds	20 minutes	8 minutes	8 hours
11	20 seconds	20 minutes	12 minutes	12 hours
12	20 seconds	20 minutes	16 minutes	16 hours
13	20 seconds	20 minutes	24 minutes	24 hours

No more than seven historical trend reports (the first seven that the printer receives) can be generated from one data report. This assumes that the data report is generated every 20 seconds. If the trend data report is generated every 10 seconds, configure the trend reports so that no more than three historical triggers turn ON in a single data report.

Kaye imposes these limits because the printer cannot accept new data reports while it is busy printing historical trends. The system stores new data reports in its text output buffer until the printer finishes printing all historical trends. The text output buffer is a temporary storage location; in the Digi 4 Plus it can hold 8192 bytes of information, and in the standard Digi 4, 4060 bytes. To avoid a buffer overflow and a potential loss of data, you should calculate the maximum number of bytes that will be stored in the text output buffer. Each data report requires 140 bytes of memory.

Triggers

Triggers control trending. They initiate the trend, select live or historical trending, select the data from the fast or slow buffer and clear the print buffers. A trigger can be a Kaye I/O Relay (01-48), a Status Input (51-82) or you can select two special triggers, 00 and 99. Trigger 00 is always ON and trigger 99 is always OFF. Trigger 00 is the highest priority trigger, followed by Relays 01-48, Status Inputs 51-82 and trigger 99.

The triggers must stay set for at least the time interval of the trend data report (10 or 20 seconds). Otherwise, the printer may not detect the ON or OFF transition.

Relay triggers are usually turned ON when a limit is exceeded or when a series of user-specified conditions are satisfied. They normally remain ON for at

least 10 or 20 seconds. However, to guarantee that the relay trigger remains ON for the time interval of the trend data report, you can program a flip-flop function to latch the relay trigger ON.

Status input triggers are turned ON by external switches. To guarantee that the status input trigger remains ON for the time interval of the trend data report, use a toggle, not a momentary switch. If you must use a momentary switch, you can program a flip-flop function to latch the status input trigger ON.

Live or Historical Triggers. Triggers can be turned ON by an event, such as a limit exceeded, by an operator, or at a user-specified time interval. You can configure the system to trigger trends at different time intervals or by different events. For example, the system can generate an hourly trend that shows what happened at one-minute intervals during that hour, start a trend when an operator presses the LOG or TRIGGER keys, automatically trend performance data after starting a batch operation or generate multiple trends when an alarm condition occurs.

The printer checks the live triggers first. Live triggers have a higher priority than historical triggers. If more than one live trigger is active, the system initiates the trend with the highest priority trigger. Trigger 00 has the highest priority, followed by Relays 01-48 and then Status Inputs 51-82. If more than one trend has the same live trigger (and it is ON), the printer initiates the trend report with the highest priority. Trend report number 1 has the highest priority, followed in order by trend reports 2-9.

The printer continues trending until one of the following occurs: the live trigger turns OFF; a higher priority live trigger turns ON; the printer detects an error or format change or receives another type of Kaye I/O document, for example, a message or standard data report. When you set up the trend data report, you can direct the printer to abbreviate the trend when any one of these conditions occurs. If you do not select the abbreviate trend option, the printer stops plotting the data points and fills the remainder of the page with blank grids.

If no live triggers are ON, the printer compares the historical triggers in the most recent trend data report with those of the previous trend data report. It begins with trend report number 1 and checks if its historical trigger has turned ON since the last trend data report.

NOTE

The printer does not check the previous state of an historical trigger after a format change.

If more than one historical trigger turns ON in the same trend data report, the printer begins printing the trend report with the highest priority. Each historical trend appears on a new page.

Fast or Slow Print Buffer Triggers. The Kaye I/O stores trend data in two print buffers: the fast print buffer and the slow print buffer. The terms "fast" and "slow" refer to the interval between storage of data points.

The fast print buffer stores the most recent samples of data. The interval between data points is either 10 or 20 seconds. The slow print buffer receives data from the fast buffer at a specific interval (from 1 to 24 minutes). The chart speed you select determines the interval.

Although the printer can trend data from the fast or the slow print buffer, you usually configure the trends so that live trending is from the fast buffer and historical trending is from the slow buffer.

Each print buffer can store 61 samples. A sample contains the date, time and data from 32 channels. After the print buffer is full, the printer deletes the oldest sample when it receives a new data report. A trigger determines which buffer is used. When the trigger is ON, the printer trends data from the fast print buffer. When the trigger is OFF, the printer trends data from the slow print buffer. For example, if you select Relay 05 as the trigger for the print buffer, the printer can trend data from the slow buffer during normal operating conditions. But, if an alarm occurs, the system can turn ON Relay 05 and begin trending data from the fast buffer.

If you select 00 as the trigger for print buffer, the printer trends data from the fast print buffer. (Trigger 00 is always ON.) If you specify 99 as the trigger for print buffer, the printer trends data from the slow print buffer. (Trigger 99 is always OFF.)

Clear the Print Buffer Triggers. There are triggers to clear the print buffers. If you no longer need the data in the print buffers, or change a parameter and want to begin trending with new data, you can specify a clear buffer trigger. One trigger clears the print buffer before trending and the other clears the print buffer after trending. When the trigger turns ON, all trend data is deleted from the print buffer.

The Kaye I/O also clears the print buffer when you perform a print test.

Buffering Reports

The Kaye I/O generates a data report every 10 or 20 seconds based on the chart speed you select. When a report is generated, it enters a temporary storage location called the text output buffer. Usually reports pass directly from the text output buffer to the print buffer. However, if the printer is busy printing or off-line, the text output buffer holds the data reports until the printer can accept them. In the Digi 4 Plus, the text output buffer's capacity is 58 reports; in the standard Digi 4, the capacity is 29 reports.

When you configure the trend report, specify the number of data reports to buffer to avoid losing any data reports triggered while the printer was busy. For example, it takes approximately 72 seconds to print a full-page historical trend report. During this time, up to seven 10-second data reports will have triggered. If you set up the Kaye I/O to buffer seven data reports, the printer can service the reports when it finishes trending.

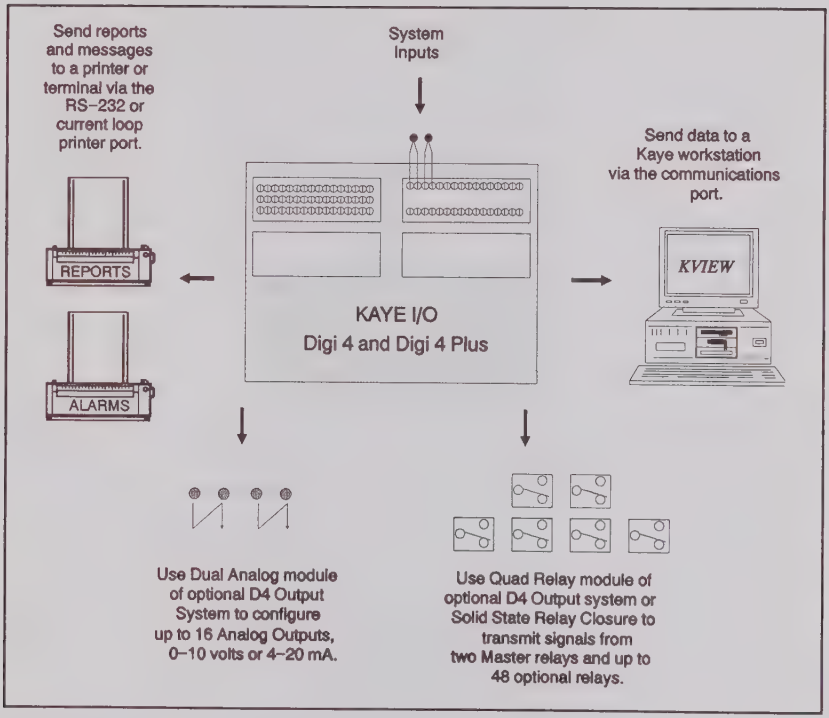

Send reports and messages to a printer or terminal via the RS–232 or current loop printer port.
System Inputs
Send data to a Kaye workstation via the communications port.
REPORTS
ALARMS
KAYE I/O
Digi 4 and Digi 4 Plus
KVIEW
Use Dual Analog module of optional D4 Output System to configure up to 16 Analog Outputs, 0–10 volts or 4–20 mA.
Use Quad Relay module of optional D4 Output system or Solid State Relay Closure to transmit signals from two Master relays and up to 48 optional relays.

Figure 6-21. System Outputs

System Outputs

In addition to outputting reports to a printer or display terminal, Kaye I/O can send data to KVIEW or Mini-KVIEW process monitoring software.

It can also output analog signals for control, trend recording, X-Y plotting or indication. With the Dual Analog module of the Kaye D4 Output system, you can transmit two isolated analog signals to your process. Each Kaye I/O unit supports up to 16 analog outputs.

The states of the Kaye I/O's 48 relay logic bits can be output to up to 48 optional solid state relay closures. Use the Quad Relay module of the D4 Output System or the Solid State Relay Closure to transmit discrete signals.

The 2 master relays built into Kaye I/O systems can turn on external devices such as annunciators. To specify master relay operation, select Configuration at the programming menu.

Appendix A: Key Commands

Programming mode

ALT-C	Clear field, cursor to end
ALT-F1	Item or field help
ALT-H	Function help (channels, multi-channels only)
ALT-K	Kaye I/O help
ALT-P	Program Kaye I/O and continue
ALT-S	Screen help
ALT-T	Template (Channels, Multi-channels, Messages, Sequencers, Multi-sequencers, Auto-Trend)
ALT-V	View Data menu
BKSP	Delete previous character
CTRL-V	View output data (Channels, Multi-channels) or reset times (System Timers)
DEL	Delete cursor character
ESC	Exit
F1	Program Mode Action Key menu
F9	Programming menu
INS	Insert character in data field
NULL	(Enter the word) Clear Input, Output or Limit field; disable operation or reset defaults
PG DN	Program Kaye I/O and go to next address
PG UP	Program Kaye I/O and go to previous address
TAB →	Next field
TAB ←	Previous field
→, ←	Cursor right, left within field

Calibration mode	ALT-F1	Item or field help
	ESC	Cancel calibration procedure; save calibration or sensor report to file
	F1	Screen help
	PG DN	Return to the Calibration Point screen
	PG UP	Return to Sensor Calibration Setup screen
	TAB →	Next field
	TAB ←	Previous field
Utilities mode	ALT-F1	Item help
	ALT-F2	Print miscompare file
	ESC	Exit
	F1	Screen help
	F2	Display miscompare file
	F8	Start

Appendix B: The Programmer Files

The Programmer files are contained in the C:\KPROG directory.

Do not delete or modify these program files:

*.EXE
*.TMP
*.FIL
*.HLP
*.DAT

You *can* copy, archive or delete user-created programming, calibration report or backup files:

*.BKP
*.RPT

You can create, archive or delete template files:

*.TPL

Appendix C: Hex - ASCII Equivalents

00 NUL	20 SP	40 @	60 \
01 SOH	21 !	41 A	61 a
02 STX	22 "	42 B	62 b
03 ETX	23 #	43 C	63 c
04 EOT	24 $	44 D	64 d
05 ENQ	25 %	45 E	65 e
06 ACK	26 &	46 F	66 f
07 BEL	27 '	47 G	67 g
08 BS	28 (	48 H	68 h
09 HT	29)	49 I	69 i
0A LF	2A *	4A J	6A j
0B VT	2B +	4B K	6B k
0C FF	2C '	4C L	6C l
0D CR	2D -	4D M	6D m
0E SO	2E .	4E N	6E n
0F SI	2F /	4F O	6F o
10 DLE	30 0	50 P	70 p
11 DC1 (X-ON)	31 1	51 Q	71 q
12 DC2 (Tape)	32 2	52 R	72 r
13 DC3 (X-OFF)	33 3	53 S	73 s
14 DC4 (Tape)	34 4	54 T	74 t
15 NAK	35 5	55 U	75 u
16 SYN	36 6	56 V	76 v
17 ETB	37 7	57 W	77 w
18 CAN	38 8	58 X	78 x
19 EM	39 9	59 Y	79 y
1A SUB	3A :	5A Z	7A z
1B ESC	3B ;	5B [	7B {
1C FS	3C <	5C \	7C
1D GS	3D =	5D]	7D }
1E RS	3E >	5E ^ ( )	7E
1F US	3F ?	5F – ( )	7F DEL

Appendix D: Editing Operator Menu

The text of the Operator Menu can be translated or replaced with terminology that fits your process. It is not possible, however, to change the purpose of the menu item, only its name.

1. Enter the \KPROG directory.

2. Make a copy of the MAIN file and rename. We recommend that you make a copy so you can restore the original file. For example, rename the existing MAIN file to XMAIN.

3. Using a DOS editor, edit the existing text. You must keep the field names at approximately the same length as the original text. Do not change the numbers 1 or 2 or the letter as this will affect the operation of the Programmer.

```
            Operator Menu

  1 - Kaye Programmer Utility

  2 - COLLECT Utility

    - - - - - - - - - - - - - - -

  X - Exit to DOS

      Press 1, 2 or X
$$
```

Glossary

Address
Three digits that identify the source of input data or a trigger.

Alarm condition
A limit trip or invalid data.

Alarm Status report
Record of channels currently in alarm condition.

Analog input
Varying process voltage signal that is connected to an input scanner.

Analog output
A value that is calculated in the Kaye I/O hardware and sent to an Analog Output module for conversion to a voltage or current signal.

Auto-Trend
Kaye I/O feature that automatically graphs live or historical data from up to 32 channels.

Backup
Programmer utility that copies the program at a Kaye I/O hardware unit to a file.

Backup file
Duplicate of a Kaye I/O program.

Bank, scanner
Group of 16 analog or status input connections assigned a unique number.

Buffer, historical
Temporary, first in-first out storage area for 32 data samples from a channel of CALC channel. The values are used with Historical Buffer functions.

CALC channel
One of 99 Kaye I/O workspaces similar to channels. Used mainly for calculation. Does not accept direct input, functions that output logical data, or functions that generate a one-line message. Identified by three-digit address 001-099.

Calibration
Programmer features used to correct thermocouple and RTD readings to a NIST-traceable temperature.

Channel
One of 128 workspaces in Kaye I/O. Some channels accept input data and convert it to engineering units. Other channels accept function for data analysis and reduction. Identified by three-digit address 101-116, 201-216...801-816.

Channel Map
Feature of The Programmer that displays channels in tabular form, identified by 8-character labels.

Chart speed
Historical trend parameter that determiones how much data (in units of time) appears on each page, the time between data samples, and how often samples are copied from the fast to the slow print buffer.

Compare
Utility that compares a file with the program at a Kaye I/O unit, and lists miscompares by area and address.

Constant address
Three digits that store a specific constant value or a pair of constants used with Multi-Segment or Polynomial functions.

Digital input
Discrete high/low electrical signal that indicates the On/Off state at a process switch or pushbutton and enters the Kaye I/O via a Status Input scanner.

Fast print buffer
One of two text buffers used to store trend report data. The fast buffer stores the most recent samples of data. The interval between samples can be either 10 or 20 seconds. Generally you use data from the fast print buffer for live trends.

Function
Built-in routine for manipulating data. Kaye I/O functions range from simple input data conversions to complex application-specific computations. Assigned by user to channel or CALC channel address.

Historical trend
One-page graphic or digital trend report of data from up to 12 channels. Data is stored temporarily in the print buffer until the trend trigger goes from OFF to ON. The time period covered can range from 10 minutes to 24 hours.

Hysteresis
Dead band applied to a limit, affecting the return to normal state only. The hysteresis count, a value from 1 to 10, is applied to the least significant digit of a limit. For example, if a channel high limit is 100.0 with a hysteresis count of 5, the channel will go into alarm as soon as channel data reaches 100.0 but will return to normal only when the temperature falls below 99.5.

Initialize Kaye I/O
To carry out a hardware procedure that erases the program at the Kaye I/O and sets unit to defaults:
System clock = 01/01/01; 00:00:00
Analog inputs at Bank 1 sent to Channels 101-816
Channels 101-116 = 60 mV function;
201-816 = Skip function
Data Report 1 contains data from Channels 101 116, a numeric header, relays and status inputs. Channels formatted 16/line. Sent to printer when LOG key is pressed.
Limit and sequencer messages sent to printer port, 99 buffered
Printer port = 2400 baud, 48 lines/page
Peripheral port = 2400 baud
Master Relays normally de-energized, set for static operation
Program Mode Password = 000000; disabled

Initialized file
New programming file with all addresses set to Kaye I/O defaults.

Input 1, Input 2
Channel registers that store values required by the assigned function.

Intelligent RTD Probe
Probe used in calibrating thermocouples and RTD's. Has onboard A/D converter that corrects resistance measurement according to calibration coefficients stored in EEPROM and converts data simultaneously into °C and °F.

Invalid data
Open circuit or over-range data at channel.

Listing
Programmer utility that prints out a programming or backup file, including Channel Map and Channel Summary.

Live trend
Data from up to 12 channels printed in graphic or digital format as soon as it is sent to the print buffer, provided the Live Trigger is ON.

Logic address
Three digits that specify the location of the logic bit used as input for logical functions, to trigger reports, or to reset accumulation totals and intervals.

Logic bit
Indicator signalling ON/OFF (TRUE/FALSE, 1/0) state. Stored at a three-digit logic address 000-099, 101-816, or 901-916.

Master Relays
Two output relays standard on each Kaye I/O unit. The Master Relays receive their signal from the odd and even relay logic bits.

Miscompare
Inconsistency between a file and the current program at a Kaye I/O unit.

Numerical address
Three digits that specify the source of the input data.

Output 1, Output 2
Channel registers that store values required by the assigned function.

Relay address
Three digits that store a specific relay logic bit (001-048) used as input for logical functions, to trigger reports, to reset accumulation totals and intervals, or to provide output signals to optional relay closures.

Relay, latched
Relay address that, in a power outage, holds its state prior to the power down.

Restore
Utility that loads a file to a Kaye I/O unit.

Status Input scanner
Transmits discrete high/low electrical signals from external switches to pre-assigned logic addresses 051-082 in the Kaye I/O.

Sequencer
Kaye I/O function that tests status inputs and logic states against current process conditions in search of a match. When it finds a match, the Sequencer function moves to the output step specified by the match address, and sets relays according to user instructions.

Slow print buffer
One of two text buffers used to store trend report data. The slow buffer receives data samples from the fast buffer at specified intervals ranging from 1 to 24 minutes. The buffer holds trend reports of from 1 to 24 hours duration.

Trigger
Logic bit that initiates an action such as outputting a report or resetting an accumulation total when the logic bit goes from FALSE to TRUE.

Index

Accumulation totals
  configuring 3-7
ALT-C 2-8, 2-12
ALT-F1 2-3
ALT-F2 5-7
ALT-K 2-3
ALT-M 3-24, 3-28
ALT-P 2-9
ALT-S 2-9
ALT-T 2-12, 3-15 to 3-20
ALT-V 2-10
Analog Input scanners 6-3
Analog outputs
  configuring 3-4
  with D4 Output 6-51
Auto-Trend 3-31, 6-38 to 6-49

Backup utility 5-2
  starting 5-3
Backup copies, making 1-6
Baud rate, setting 1-4
Bridge Conditioners 6-3

CALC Channel Map 3-8, 6-17
CALC channels 6-16, 6-17
Calibration 4-2, 4-8
  Calibration procedures 4-14
  Deviation evaluation 4-20
  Mid-point Check 4-18
  one-point calibration 4-11
  Pre-test Calibration 4-14
  Post-run Calibraiton check 4-24
  Setup Probe 4-10
  Stability Evaluation 4-19
  two-point calibration 4-11
Calibration documentation 4-1, 4-12
  Calibration Summary Report 4-12, 4-13,
  Corrected Results Reports 4-22, 4-23
Calibration Interface 4-9
Calibration Summary Files 4-13 4-25
  Printing 4-26
  Viewing 4-26
Channel(s)
  definition 6-5
  function-specific parameters 6-10
  label 3-8, 3-10, 6-11
  as logical sources 6-29
  multi-channel programming 2-12, 3-14
  as numerical sources 6-29
  output data resolution 3-10, 6-11
  programming 3-8, 3-14, 6-11
  real-time output value 2-11, 3-20
  unit 6-11
Channel Map 2-7, 3-8, 5-9
Channel Summary 5-9
Chart speed 6-43, 6-44
Comm port, configuring 3-4
Compare utility 5-6
  displaying miscompare file 5-7
  exceptions 5-6
  printing miscompare file 5-7
Computer requirements 1-2
Configuration 3-3
  optional parameters 3-3
Constant(s) 3-21, 6-18 to 6-19
  input 3-21, 6-19
  output 3-21, 6-19
Copying data 2-12
Copy utility 5-13
CTRL-V 2-11, 3-20, 3-23

Data, saving 2-9
Date and Time
  programming 3-1
Day of the week, selecting 3-2
Defaults, Kaye I/O G-4
Delete utility 5-10
Description(s)
  channel 3-13, 6-11
  for Kaye I/O addresses 2-9
Deviation Evaluation 4-2, 4-20
Digital Input Scanners 6-3
Disk file 2-1, 2-2, 2-5, 2-6, 5-1, 5-12
Documentation, program 2-9

Editing a screen 2-8
Epson compatible printers 1-2, 5-9
ESC 2-3, 4-2
Exiting
  Calibration 4-13
  Off-line Programming 2-13
  On-line Programming 2-13

F1 2-3
F2 5-7
F9 2-11
Fast print buffer 6-47
File(s)
  changing descriptor 5-13
  for different models 2-7, 5-5
  install 1-6
  miscompare 5-7
  on-line 2-1, 2-5 to 2-6, 5-12
  template 3-19
  The Programmer B-1
Frequency Scanners 6-3
Function(s)
  additional parameters 6-9
  assigning to channels 6-6, 6-7
  data analysis/reduction 6-7
  and hardware models 2-7, 3-9 to 3-10, 6-9
  input 6-7
  list 6-8, 6-9
  sources 6-12, 6-13
  multi-channel 3-13
  programming 3-9
  selecting from menu 3-9

Good Manufacturing Processes 4-2

Hardware requirements 1-2
Help keys 2-3
Hex - ASCII Equivalents C-1
Historical buffer(s)
  data source 3-26
  programming 3-26, 6-31
  trigger 3-26
Historical Buffer functions 6-33
Historical trends 6-43 to 6-45
Hysteresis 3-12, G-4

Initialize I/O 2-1, 2-2, 2-5, 5-1, 5-12, G-4
Input 1, Input 2 3-11, 6-11, G-4
Installing the software 1-6
Intelligent RTD Probe 4-3
Interval, timer 3-22
I/O ports, configuring 3-4

K_PATH 1-6
Kaye I/O
  defaults G-4
  display range 3-21
  models 1-2, 2-7
  network, configuring 3-4
  program listing, configuring 3-4
  system architecture 6-1, 6-2
Key commands 2-3, A-1 to A-2
  for editing screens 2-8
  help 2-9

KVIEW 6-51
On-line Programming with 2-5
and System Timers 3-23, 6-27

Label(s), channel 3-8, 3-10
Limit(s)
exceeded, return to normal 3-12
hysteresis 3-12, G-4
and logic functions 3-13
messages 3-7, 3-12
programming 3-11, 6-11
resolution 3-10
Listing 5-8
Channel Summary 5-9
Live trends 6-43
Logic addresses 6-21, G-5
viewing real-time states 2-10

MAKECOL 1-6
MAKEMON 1-6
Master relays
configuring 3-5
and external devices 6-51
Message(s) 3-24, 6-37
Auto-Dial numbers 6-37
destination, configuring 3-7
limit and return 3-12, 6-37
report headers 6-37
sequencer 6-37
STX and ETX 6-37
templates 3-25
valid characters 3-24
Mini-KVIEW 2-5, 3-2, 6-27, 6-51
Miscompare file 5-7
Monitor
changing type 1-6
Multi-channel functions 3-10, 3-13
Multiple addresses
programming 2-12, 3-14, 3-28

NULL 3-10, 3-11, 6-11

Off-line programming 2-6 to 2-7
On-line programming 2-4 to 2-6
file-I/O match 2-1, 2-5, 5-1, 5-12

Operator menu, 1-7
editing D-1
Operator password, 1-7
Output 1, Output 2 3-11, 6-11
Output field, multi-channel
functions 3-10

Password(s)
defining 5-10
Kaye I/O 3-5
usage 1-7
with KVIEW 5-10
PG DN 2-9
PG UP 2-9
Post-Test Calibration check 4-14
Pre-test calibration 4-16
Print Calibration Summary Files 4-17
Printer(s)
and Channel Summary listing 5-9
Printer port, configuring 3-4
Program documentation 2-9
Program listing, configuring 3-4
Program mode
from operator panel 2-6
Programming
areas, switching 2-11
menu 2-4, 2-11
multi-channels 2-12, 3-14
multi-sequencers 2-12
Off-line 2-6 to 2-7
On-line 2-4 to 2-6

Read Template 3-19
Real-time data, viewing 2-10, 3-20,
3-23
Reference Value in Channel 4-10
Relay(s)
as function sources 6-21
Relay Latching Configuration 3-30,
6-21
Relay outputs
with D4 Output or SSRC's 6-51
and sequencer function 3-27
Report(s)
alarm status 3-6
calibration 4-3, 4-10
configuring 3-6
data 3-6
reserved for KVIEW 3-6, 6-35
trend 3-31, 6-38 to 6-49
Reset, timer 3-22
updating 3-23, 6-27
Resolution, channel data 3-10, 6-11
Restore 5-4
caution notes 5-4, 5-5
errors 5-5
RTD Input scanners 6-3

Save Template 3-19
Saving the data 2-9
Scanner(s), input 6-3
bank number 3-4, 6-5
jumper switch 3-4, 6-5
mapping to channels 3-4, 6-4 to 6-5
Security, configuration 3-5
Sensor calibration 4-2, 4-8
Sequencer Configuration 3-27
inputs and outputs 3-28
messages, configuring 3-7
multiple addresses 3-28
templates 3-29
Setup Calibration
Connecting 4-8
Kaye Calibration Interface 4-9
Setup Probe feature 4-10
Slow print buffer 6-47 to 6-48
Source 1, Source 3-11, 6-11
Sources
list of 6-12
logical 6-20 to 6-29
numerical 6-14 to 6-19, 6-29
Stability Evaluation 4-2, 4-19
Starting The Programmer 1-6
Status input(s) 6-5, 6-23
and sequencer function 3-28
Status Input scanners 6-3
Supervisor password, 1-7
Switching program areas 2-11
System clock, resetting 3-1, 6-27
System inputs 6-3
System outputs 6-51
configuring 3-4
System Timers. *See* Timer(s)

Temperature measurement
standards 4-3, 4-16, 4-18
Digi channel 4-3
Kaye IRTD probe 4-3
Temperature references 4-2, 4-4
RTD inserts
setpoint
Template(s) 2-12, 3-15, 3-25, 3-29,
3-32
channel 3-15 to 3-20
file, creating 3-19
Timer(s) 3-1, 3-22, 3-23, 6-25
Trend report(s) 6-38 to 6-49
defining 3-31
templates 3-32

Trigger(s), defining
accumulation totals 3-7
message 3-7
report 3-6
for trends 6-45 to 6-49

Unit(s), for channel data 3-10
Unit ID
entering 2-6
setting 1-4
U.S./European Data Format 3-5
Utilities 2-2, 5-1
Backup 5-2
Compare 5-6
Copy 5-13
Delete 5-10
Initialize I/O 5-12
key commands 5-1
Listing 5-8
Password 5-10
Restore 5-4

View Data 2-10, 3-20, 3-23
View Template 3-19

Wiring
9-pin port to Kaye I/O 1-3
25-pin port to Kaye I/O 1-3
for extended distances 1-4
interface converters 1-4

Kaye Instruments, Inc. • 15 De Angelo Drive, Bedford, MA 01730 • 617-275-0300 • FAX 617-275-9024